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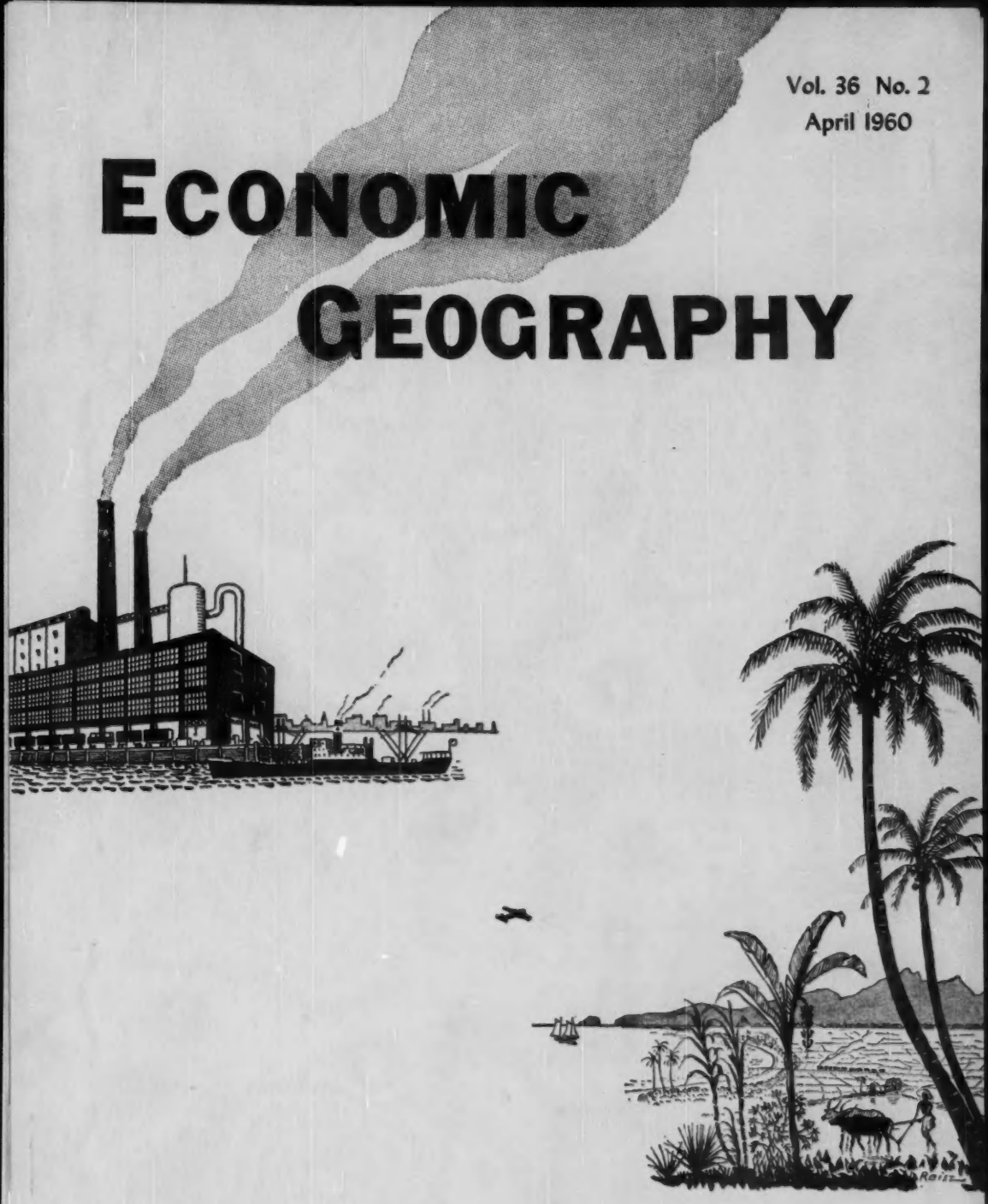

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This magazine publishes articles in the field of economic geography as well as articles in adjacent fields that contribute to an understanding of the world's economic patterns.

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LORD KELVIN RIDES AGAIN

We live, undoubtedly, in the Quantified Age; and by no means can a sane man contract out of his century. It is very clear nowadays that the basic skills of geography must generally include some statistical competence: in a very few branches of the subject can the young geographer consider himself adequately trained unless he has numerical *nous* beyond averages and medians.

And yet, allowing that one must stay inside one's century, dare one hint that there may be some danger in too-ready surrender to its trends? Twice within a few weeks, in work by good geographers, I have met an uncritical flourishing of Lord Kelvin's famous dictum: "when you cannot express it in numbers, your knowledge is of a meagre and unsatisfactory kind . . . ." Is it, always?

Let us take a simple example and look at Spain's two "million cities," Madrid and Barcelona; we will play fair and not produce a trivial *reductio ad absurdum*. If we analyzed for example, the occupational structures of the two, we would certainly find marked differences, the one more pronouncedly administrative and professional, the other industrial and commercial. This is precise quantified knowledge, which in some contexts is useful and significant. If we want to *describe* Spain, this is good enough; but if we want to *understand* Spain?

Madrid is in origin and essence a focus of state power, consciously established as such by a centralizing monarchy; Barcelona, a city of merchant and later industrial capital, consciously opposed, as focus of a deep-rooted and intense regional separatism, to the centralizing symbol and reality of Madrid. This is not precise quantitative knowledge; is it less satisfactory and more meagre, for the purpose of understanding Spanish geography, than the statistical data? These may help us to ask the right questions and to drive the answers home, but in themselves, unaided by the nonquantitative data, they are less meaningful than the latter. Each approach reinforces the other; but in this case the balance of indebtedness is owed by and not to statistics.

Kelvin's words neglect the truth that what we can count is not *always* significant; and when he claims validity for them "whatever the matter may be" he is, with respect, going far beyond his book. Perhaps in some distant future we may be able to punch a card for every human motive or emotion; but that time is not yet, and meanwhile it is simple folly to assume that imponderables are, in Kelvin's phrase, but "the beginning of knowledge." And the end of knowledge itself may be but the beginning of wisdom.

There is no doubt at all that quantification can add greatly to the precision of our techniques and thereby of our understanding—on one condition: that we recognize it for what it is, a servant and not a master. But there is a tendency to mistake the mechanics of scientific method for its soul; and surrender to this betrays insecurity, a lack of confidence in the validity of one's own work unless decked out in striking but perhaps ill-fitting garments. The soul of scientific method is verification, and that is not always numerical. Render unto UNIVAC those things that are UNIVAC'S; but remember that statistics are at best but half of life. The other half is understanding and imaginative interpretation.

O. H. K. Spate

ECONOMIC GEOGRAPHY

VOL. 36 APRIL, 1960 No. 2

INTERNATIONAL TRADE: SELECTED TYPES OF WORLD REGIONS

John W. Alexander

Dr. Alexander is Associate Professor of Geography at the University of Wisconsin. Several previous articles by him have appeared in this magazine.

ECONOMIC geography endeavors to understand regions of the earth's surface in terms of production, exchange, and consumption of wealth. Comprehending such knowledge is expedited by classifying information about economic activities on a regional basis. Classification systems themselves are not the goal; at best they are merely "filing systems" for informative material. They expedite the understanding of a large number of items by grouping similar ones into classes, resulting in a smaller number of groups more readily comprehended. But the number of categories must be large enough to recognize significant differences between items else the very purpose of classification is defeated. To that end the scholar who applies geography's method of analysis to the topic of international trade must decide which characteristics of each country's trade enable the distinguishing of *types* of countries. These *variable characteristics* serve as the measurements by which categories are quantified. The present article proposes a few classification systems for regionalizing data on international trade and is predicated on the philosophy that no one system is "best" but that, depending on the objective, each system makes a contribution to understanding areal differences of international commodity exchange.

DATA SOURCE

The *United Nations' Yearbook of International Trade Statistics* presents data on exports and imports by commodities, by source of imports, and by destination of exports for approximately 100 reporting units (mostly nations) responsible for 98 per cent of the world's international trade. This study is based on the 1954 Yearbook.

AMOUNT OF INTERNATIONAL TRADE BY NATIONS

The general pattern of world trade (Fig. 1) is well known, has been mapped by others,[1] and needs little elaboration at this point. In 1954 there were two major regions, western Europe and

[1] Andreas and Lois Grotewold: "Some Geographic Aspects of International Trade," *Econ. Geogr.*, Vol. 33, 1957, pp. 257–266; W. S. and E. S. Woytinsky: "World Commerce and Governments Trends and Outlook," The Twentieth Century Fund, New York, 1955, pp. 59, 61 and 107.

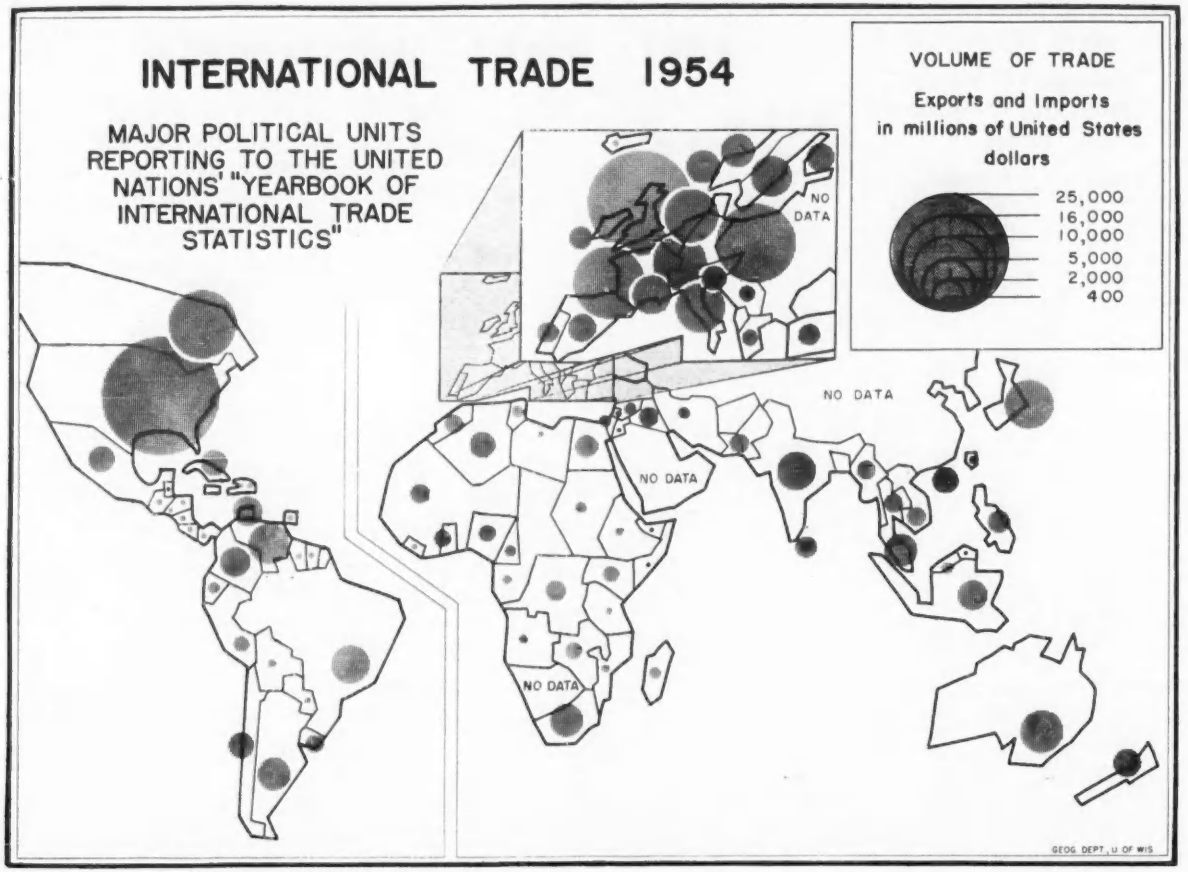
INTERNATIONAL TRADE 1954
MAJOR POLITICAL UNITS REPORTING TO THE UNITED NATIONS' "YEARBOOK OF INTERNATIONAL TRADE STATISTICS"
VOLUME OF TRADE
Exports and Imports in millions of United States dollars
25,000
16,000
10,000
5,000
2,000
400
NO DATA
NO DATA
NO DATA
NO DATA
GEOG. DEPT., U. OF WIS.

FIG. 1.

TABLE I

INTERNATIONAL TRADE BY REGIONS AND NATIONS

DATA SOURCE: UNITED NATIONS YEARBOOK OF INTERNATIONAL TRADE STATISTICS, 1954

(For explanation of symbols, see footnotes at end of table)

	(1) Exports	(2) Imports	(3) Exp. / imp.	(4) Sum of imports and exports	Regional classification (5) by exports	(6) by imports	(7) Proximity	Commodity classification (8) by exports	Major item	(9) by imports	Major item
	Millions of United States dollars		%								
WORLD TOTAL	** 76,250	** 78,650	..	154,900	.....	.....	.....	..	.....	..	.....
ANGLO-AMERICA											
Canada*	4,055	4,204	96	8,259	N'u'E	N'u'	67 Y	mc	paper	my	machy.
United States*	14,967	10,312	144	25,279	E-c	M-c	27 Y	my	vehicles	mf	coffee
MIDDLE AMERICA (North America)											
Br. Honduras*	6	8	75	14	EkNM	EkN	s N	c'	wood	mf	textiles
Costa Rica*	81	80	101	161	N'u'E	N'u'E	s N	f'	coffee	m'	textiles
Cuba	640	489	131	1,129	N'u'	N'u'	68 Y	f'	sugar	my	textiles
Dominican Rep.*	119	82	145	201	N'u'E	N'u'	s N	f'	sugar	m	steel
El Salvador*	105	86	122	191	N'u'	N'u'	s N	f'	coffee	m'	textiles
Guadeloupe	33	36	91	69	E'f'	E'f'	s N	f'	sugar	m	textiles
Guatemala	96	86	112	182	N'u'E	N'u'	s N	f'	coffee	m^w	textiles
Haiti	54	47	115	101	E'Nu	N'u'	s N	f'	coffee	m	textiles
Honduras*	56	51	110	107	N'u'	N'u'	s N	f'	bananas	m'y	textiles
Jamaica*	95	104	91	199	E'k'N	EkN	s N	f'	sugar	m	textiles
Mexico*	563	723	78	1,286	N'u'	N'u'	77 Y	c'	cotton	ym	vehicles
Nicaragua	54	58	93	112	NuE	N'u'	s N	f'	coffee	m	textiles
Panama*	17	72	24	89	N'u'	N'u'	s N	f'	bananas	m'	misc.
(South America)											
British Guiana	48	42	114	90	EkN	E'k'N	s N	f'c	sugar	m'y	vehicles
Colombia*	644	650	99	1,294	N'u'	N'u'E	s N	f'	coffee	my	vehicles
Neth. Antilles*	771	818	95	1,589	NuE	M'v	41 Y	m'	petrol.	c'	cr. oil
Surinam	28	27	104	55	N'u'	N'u'E	s N	c'	bauxite	m	machy.
Trinidad*	152	145	104	297	E'k	EkM	12 N	m'	petrol.	mc	cr. oil
Venezuela	1,689	819	207	2,508	M'e'N	N'u'E	35 N	c'	cr. oil	ym	vehicles
SOUTHERN HEMISPHERE AMERICA											
Argentina*	1,062	954	111	2,016	E'k	Eu	20 N	f'c	grains	m	steel
Bolivia	142	92	154	234	N'u'E	NuS	12 N	c'	tin	fm	wheat
Brazil*	1,561	1,631	96	3,192	ENu	NuE	10 N	f'c	coffee	m'y	petrol.
Chile	404	343	117	747	N'u'	N'u'	13 N	c'	copper	ym	machy.
Ecuador*	99	86	115	185	N'u'	N'u'E	s N	f'	cocoa	m	vehicles
Paraguay*	31	33	94	64	NuES	ENu	15 N	c'	cotton	m'	textiles
Peru	245	249	99	494	NuES	N'u'E	s N	c'f	cotton	my	vehicles
Uruguay	248	274	90	522	E'k	E-u	14 N	c'f	wool	m	petrol.
EUROPE											
Austria*	609	653	93	1,262	E'g	E'g	53 Y	m'c	wood	cm	coal
Belgium-Lux.*	2,299	2,534	90	4,833	E'n	E'g	48 Y	m'	steel	mc	wool
Denmark*	948	1,163	82	2,111	E'k	E'k	35 N	f'	meat	m	textiles
Finland*	680	656	104	1,336	E'k	E'k	22 N	c'm	wood	m	steel
France*	4,188	4,215	99	8,403	EFr	EFr	26 N	m'	steel	c'f	cr. oil
Germany, W.*	5,247	4,570	114	9,817	E'n	Eu	38 Y	my	machy.	cf	grains
Greece*	151	330	45	481	E'g	E'g	16 N	f'	tobacco	m	petrol.
Iceland*	51	69	74	120	E'-u	E'-u	20 N	f'	fish	m	petrol.
Ireland*	322	503	64	825	E'k'	E'k	70 Y	f'	meat	m	machy.
Italy*	1,636	2,401	68	4,037	E'g	Eg	30 N	m'	textiles	c'	fibers
Malta*	8	56	14	64	Ek	E'k	13 N	c'f	minerals	fm	grains
Netherlands*	2,413	2,857	85	5,270	E'g	E'g	42 Y	mf	eggs	mc	misc.
Norway*	582	1,018	57	1,600	E'k	E'k	39 N	mf	fish	my	ships
Portugal*	253	350	72	603	Ek	Ek	s N	mc	textiles	m	misc.
Spain*	464	614	75	1,078	E'k	E-u	s N	f'm	fruit	cm	cotton
Sweden*	1,587	1,777	90	3,364	E'k	E'g	32 Y	cm	pulp	m	vehicles
Switzerland	1,228	1,303	94	2,531	E'g	E'g	39 Y	m'	clocks	m	misc.
Un. Kingdom*	7,489	9,179	83	16,668	E-a	E-u	15 N	m'y	misc.	fc	meat
Yugoslavia*	240	339	70	579	E'g	E'Nu	19 N	fc	wood	ym	mach.

TABLE 1—Continued

INTERNATIONAL TRADE BY REGIONS AND NATIONS

DATA SOURCE: UNITED NATIONS YEARBOOK OF INTERNATIONAL TRADE STATISTICS, 1954

(For explanation of symbols, see footnotes at end of table)

					Regional classification			*Commodity classification*			
	(1) *Exports*	(2) *Imports*	(3) *Exp. / imp.*	(4) *Sum of imports and exports*	(5) *by exports*	(6) *by imports*	(7) *Proximity*	(8) *by exports*	*Major item*	(9) *by imports*	*Major item*
	Millions of United States dollars		%				%				
AFRICA											
Algeria	400	622	64	1,022	E'f'	E'f'	s N	f'	wine	m	vehicles
Anglo-Eg-Sudan	116	137	84	253	E'k	E'k	12 N	c'f	cotton	mf	textiles
Angola	102	95	108	197	E'Nu	E'p	s N	f'	coffee	m	textiles
Belgian Congo	396	369	108	765	E'b	E'b	s N	c	copper	my	machy.
Br. Somaliland*	3	6	50	9	A'd	EkA	37 Y	f'c	animals	mf	textiles
Cameroons	87	92	95	179	E'f'	E'f'	s N	f'	cocoa	m	misc.
Egypt*	397	458	87	855	E'fA	E'k	s N	c'	cotton	m	petrol.
Ethiopia-Eritrea	64	64	100	128	NuA	E't	25 N	f'	coffee	m	textiles
Fr. Eq. Africa	71	95	75	166	E'f'	E'f'	s N	c'	cotton	my	textiles
Fr. W. Africa	332	379	88	711	E'f'	E'f'	s N	f'	coffee	m	vehicles
Gold Coast*	294	200	147	494	E'k	E'k	s N	f'	cocoa	m'	textiles
Kenya-Uganda	178	239	74	417	E'kA	E'k	s N	f'c	coffee	my	petrol.
Liberia*	31	18	171	49	N'u	N'u'	s N	c'	rubber	m'	misc.
Libya*	10	31	32	41	E't	E't'	s N	c'	hides	mf	grains
Madagascar	92	137	67	229	E'f'	E'f'	s N	f'	coffee	m	textiles
Mauritius*	53	45	118	98	E'k'	EkA	s N	f'	sugar	mf	grains
Morocco	286	479	60	765	E'f	E'f'	s N	c'f	grains	m	sugar
Mozambique	56	80	70	136	E'p	E'p	s N	c'f	cotton	my	misc.
Nigeria*	417	319	130	736	E'k'	E'k	s N	c'f	cocoa	m'	textiles
Reunion	36	37	98	73	E'f'	E'f'	15 N	f'	sugar	m	misc.
Rhod.-Nyasa*	411	350	117	761	E'k'	EkF	23 N	c'	copper	m'y	misc.
Sierra Leone	31	37	84	68	E'k'	E'k'	s N	c'	iron ore	m'	textiles
It. Somaliland*	8	10	80	18	E't'	E't'	s N	f'	fruit	m'f	textiles
Tanganyika	103	89	116	192	E'k	E'kA	s N	c'	sisal	m	misc.
Tunisia	129	169	76	298	E'f'	E'f'	s N	c'f	grains	m	textiles
Un. S. Africa	890	1,241	71	2,131	E'kA	E'k	12 N	c'f	wool	m	textiles
ASIA											
Brunei*	89	36	247	125	.....	....	....	c'	cr. oil	m'	misc.
Burma*	240	203	118	443	A'j	AEk	25 Y	f'	rice	m'	textiles
Camb.-Laos-Vt. N.	96	394	25	490	ANu	E'f	s N	f'c	rice	m'	textiles
Ceylon	350	293	120	643	Ek	AEk	s N	f'c	tea	fm	rice
China: Taiwan	93	115	81	208	A'j'	A'j'	60 Y	f'	sugar	m'	chemicals
Cyprus*	47	66	71	113	E'g	E'k	s N	c'f	copper	m'	textiles
Hong Kong*	423	601	70	1,024	A'h	AhE	18 Y	m'	textiles	m'f	textiles
India	1,182	1,255	95	2,437	Ek	EkA	12 N	mf	tea, jute	m	petrol.
Indonesia	856	629	136	1,485	AmE	AjE	20 N	c'f	rubber	m	textiles
Iran[W]	111	223	50	334	Ek	E-u	s N	c	cr. oil	m	sugar
Iraq[W]	429	203	210	632	En	E'k	s N	c	cr. oil	my	vehicles
Israel	88	289	31	377	EkN	ENu	s N	f	fruit	m	grain
Japan*	1,629	2,399	68	4,028	A-u	Nu	s N	m'	textiles	c'f	cotton
Jordan	6	38	16	44	A'l'	E'kA	46 Y	c'f	olive oil	mf	textiles
Lebanon	43	173	25	216	AsE	EAs	25 Y	f'	fruit	mf	textiles
Malaya*	1,015	1,025	99	2,040	E-u	AiE	27 Y	c'	rubber	cf	cr. oil
North Borneo*	25	24	104	49	AEk	AEk	s N	c'	rubber	mf	textiles
Pakistan	358	324	110	682	E'kA	E'k	s N	c'	jute	m	textiles
Philippines	412	451	91	863	N'u'	N'u'	12 N	c'f	copra	m	textiles
Sarawak	138	129	107	267	A'm	A'x'	47 Y	c'	cr. oil	c	cr. oil
Syria	210	174	120	384	E'f	E'-u	s N	f'c	grains	m	petrol.
Thailand*	272	313	87	585	A'j	AjE	24 N	f'	rice	m'	textiles
Turkey*	334	478	70	812	E'g	E'g	s N	f'c	tobacco	m'y	machines
AUSTRALIA*	1,658	1,685	99	3,343	E'k	E'k	s N	c'f	wool	m'y	textiles
NEW ZEALAND	683	687	99	1,370	E'k'	E'k'	s N	f'c	dairy prods.	my	textiles

**World total imports exceed total exports because of added value of transport charges.
*Nation reporting as per "Standard International Trade Classification."
[W] Data from 1955 edition of the Yearbook of International Trade Statistics.

Columns 5, 6—Regional classification by exports and imports

First capital letter: leading *region* receiving the nation's exports or originating the nation's imports. An Apostrophe (') indicates a proportion of 50 per cent or more.

E Europe
N Anglo-America
M Middle America
F Africa
A Asia including Indonesia
S Southern Hemisphere America

Other capital letters: other major *regions*, each accounting for 25 per cent of the nation's trade in order.

Lower-case letter: single leading *nation* regardless of its percentage. Apostrophe (') indicates it receives at least 50 per cent of the nation's exports or provides 50 per cent of that nation's imports. Letter is positioned after the trade region in which it is located. (-) Hyphen indicates the nation is not in the region represented by the capital letter.

a Australia	g Germany	l Lebanon	s Syria
b Belgium	h China	m Malaya	t Italy
c Canada	i Indonesia	n Netherlands	u United States
d Aden	j Japan	p Portugal	v Venezuela
e Netherlands Antilles	k United Kingdom	r Algeria	x Brunei
f France			

Column 7—Percentage is share of a nation's total trade accounted for by neighbors.

s less than 10 per cent
Y Leading trading partner *IS* a neighbor
N Leading trading partner is *NOT* a neighbor

Column 8—Lower-case letter indicates 25 per cent or more of nation's total exports:

f Foods c Crude materials m Manufactures y Machinery

Apostrophe (') indicates 50 per cent or more of total exports.
[w] Data from 1955 Yearbook of International Trade Statistics.

Column 9—Same as for Column 8 but applied to imports.

Anglo-America, which, respectively, generated $65,000,000,000 worth of trade (43 per cent of the world total) and $33,000,000,000 (22 per cent of the world total). National leaders were United States, United Kingdom, West Germany, France, and Canada.

1. Regions by Balance of Trade

Balance between exports and imports is quantified in Table I, Column 3, by means of an *export/import index*. Value of exports is divided by that of imports; the quotient is expressed on the basis of 100 for perfect balance. Thus, an index exceeding 100 indicates excess of exports; an index of 99 or less indicates excess of imports.

Most places import more than they export. Of the 99 political units reporting, 63 are in this *debtor* category. A "favorable" balance is "enjoyed" by 36 *creditors*. Notice that *debtor* and *creditor* as used herein refer only to the net debits or net credits resulting from international exchange of *commodities*. Table II lists the major creditors and debtors. Figure 2 shows the location of four types of nations in terms of *trade balance* and suggests six areas of *creditors:* (1) from the United States southeastward through Surinam; (2) southern South America; (3) middle Africa between Liberia, Rhodesia, and Ethiopia; (4) southeast Asia; (5) the Near East (Iraq and Syria); and, (6) two European nations (West Germany and Finland). All told, these creditor areas have an aggregate differential of $7,744,000,000 in exports over imports. Almost 80 per cent of this differential is credited to nations in the Western Hemisphere, and an astonishing 60 per cent of it ($4,655,000,000) is the credit of just one nation—the United States. No student of international relations can miss the fact that three-fifths of the free world's debt incurred for commodities in 1954 is owed to one creditor; and no United States citizen can think constructively about foreign policy without realizing that his country must either write off this debt as foreign aid or be willing to participate in ventures

whereby the debtors can redeem themselves.

Major regions of debtors are (1) Europe (every major nation except West Germany and Finland), (2) Africa's northern, eastern, and southern portions, (3) eastern and southern Asia, (4) Australia–New Zealand, (5) middle part of South America, (6) Canada, and a few Middle American countries. The largest deficits are those of United Kingdom, Japan, and Italy. But the lowest export/import indexes appear in Jordan, Panama, Lebanon, Cambodia, Israel, Libya, and Greece, countries in which the economy depends heavily on other income such as that from military establishments of outside powers, transport charges on traffic through the country (as oil pipelines crossing Jordan), and outside investments. The fact that the largest debts from trade imbalance occur in Europe helps explain the intense advertising campaigns in America sponsored by European countries to lure tourist dollars. Analysis of spatial variation in methods whereby debtor nations augment their incomes would be an interesting line of geographic research.

TABLE II

MAJOR COUNTRIES BY BALANCE OF INTERNATIONAL TRADE IN MILLIONS OF UNITED STATES DOLLARS, 1954

Excess of exports over imports		*Excess of imports over exports*	
ANGLO-AMERICA		ANGLO-AMERICA	
United States	$4,655	Canada	$149
MIDDLE AMERICAS		MIDDLE AMERICAS	
Venezuela	870	Mexico	160
Cuba	151	Panama	55
SOUTHERN HEMISPHERE AMERICA		SOUTHERN HEMISPHERE AMERICA	
Argentina	108	Brazil	70
Chile	61	Uruguay	26
EUROPE		EUROPE	
Western Germany	677	United Kingdom	1,690
Finland	24	Italy	765
AFRICA		Netherlands	444
Nigeria	98	Norway	436
Gold Coast	94	Belgium	235
Rhodesia-Nyasaland	61	Denmark	215
ASIA		Sweden	190
Indonesia	227	Ireland	181
Iraq	226	Greece	179
		Spain	150
		Yugoslavia	99
		Portugal	97
		Switzerland	75
		Austria	44
		France	27
		AFRICA	
		Union South Africa	351
		Algeria	222
		Morocco	193
		Egypt	61
		Kenya	61
		ASIA	
		Japan	770
		Cambodia-Laos-V. N.	298
		Israel	201
		Hong Kong	178
		Turkey	144
		Lebanon	130
		Iran	112
		India	73

Source: Computed from data in United Nations *Yearbook of International Trade Statistics*, 1954.

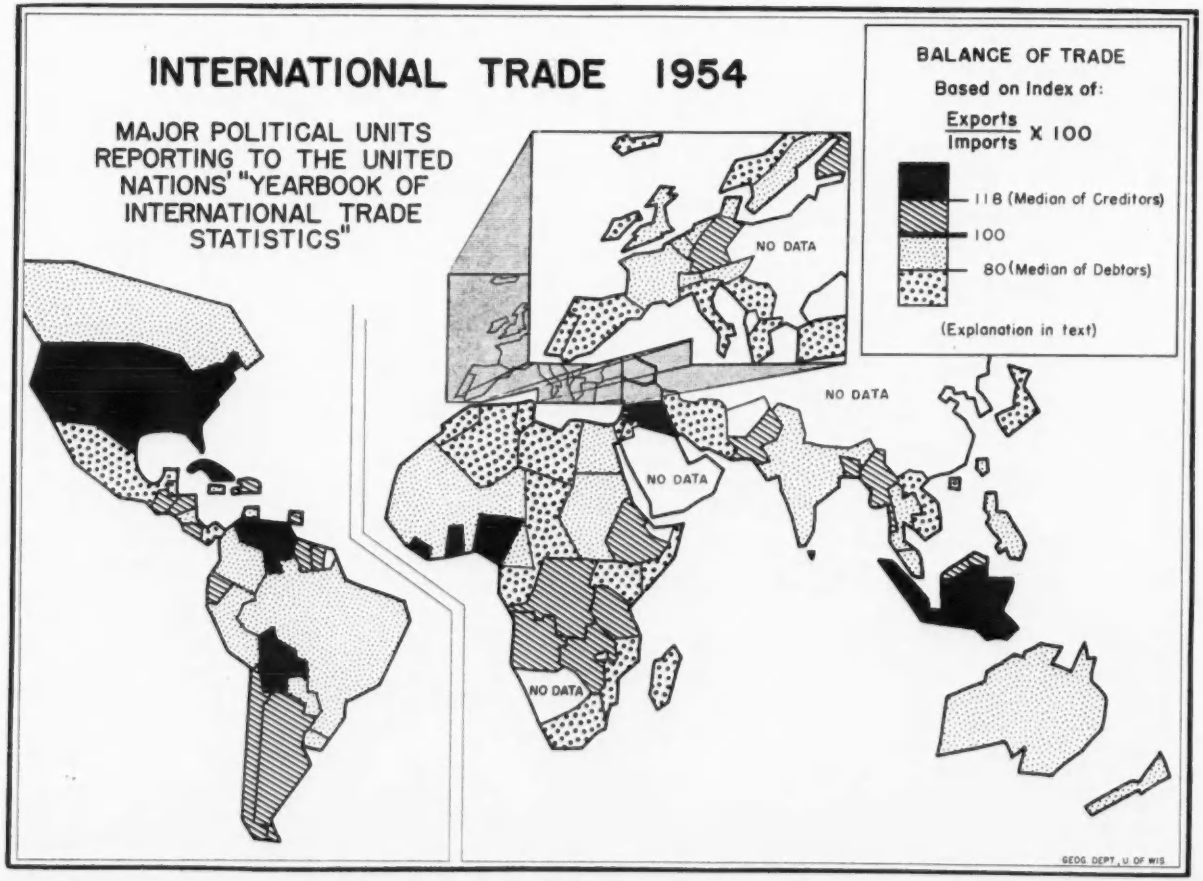
INTERNATIONAL TRADE 1954
MAJOR POLITICAL UNITS REPORTING TO THE UNITED NATIONS' "YEARBOOK OF INTERNATIONAL TRADE STATISTICS"
BALANCE OF TRADE
Based on Index of:
Exports / Imports X 100
118 (Median of Creditors)
100
80 (Median of Debtors)
(Explanation in text)
NO DATA
NO DATA
NO DATA
NO DATA
GEOG. DEPT., U. OF WIS.

FIG. 2.

2. Regions by Destination of Exports

Percentages were computed for each nation's exports destined for every major trade region and for leading nations.

Seven major trade regions were delimited: Anglo-America, Middle America, Southern Hemisphere America, Western Europe, Africa, Asia, and Australia–New Zealand. A coding system portraying the destination of each nation's exports was devised (Table I, Column 5) whereby the initial capital letter indicates the leading *region* receiving the nation's exports (e.g., Guatemala's first capital letter is *N*, indicating that her leading customer is Anglo-America). An apostrophe (') indicates that a proportion of 50 per cent or more of that nation's shipments are consigned to that region. Subsequent capital letters indicate other major *regions*, each accounting for 25 per cent of the exports, in order of rank (e.g., British Honduras ships mainly to Europe, *E*, but Anglo-America, *N*, and Middle America, *M*, each receives at least 25 per cent of British Honduras' exports). The lower-case letter indicates a single leading *nation*. An apostrophe (') after the lower-case letter indicates receipt of at least 50 per cent of the classified nation's exports (e.g., Guatemala sends over half of its exports to the United States as shown by the entry *u'*).

Column 5 of Table I indicates the destination of exports as reported by each nation, and Figure 3 is an attempt to map these nations in terms of major consignees. Most extensive is the region linked to western Europe. This area contains every nation in Europe, extends eastward as far as Pakistan, and southward over Africa; it covers much of South America, a few small nations in Middle America, and the United States. Its most remote section comprises Australia and New Zealand. In all, the European region contains 63 nations, with 29 in the *Ek* category (United Kingdom leading consignee). France was first buyer from 11 nations.

Regions exporting mainly to Anglo-America occupy much of North America, the western fringe of South America, and a few detached places: Surinam, Liberia, Ethiopia, and the Philippines. Sixteen nations identify the United States as their foremost customer.

The export-to-Asia region includes Japan and southeast Asia.

Venezuela alone reported Middle America as leading recipient. But most of her exports are crude oil shipped to Netherland Antilles which processes the oil and exports the products to the United States and Europe. Thus, one might contend that Venezuela should be classified the same as Netherlands Antilles.

There is no country having either Africa or Southern Hemisphere America or Australia–New Zealand as leading destination region for exports.

3. Regions by Sources of Imports

Each country was appraised in terms of the proportion of total imports ascribable to each of the seven trade regions and to its leading source nation. Exactly the same methods for classifying nations in terms of imports (Table I, Column 6) were used as for exports (Column 5).

Regions distinguished in terms of leading import sources are portrayed by Figure 4. Most expansive is the area receiving from Europe. It occurs on every continent, covering all of Europe, all of Africa (excepting Liberia), southern Asia, and Australia–New Zealand. In the Western Hemisphere the import-from-Europe region contains only Argentina and a few smaller nations. The

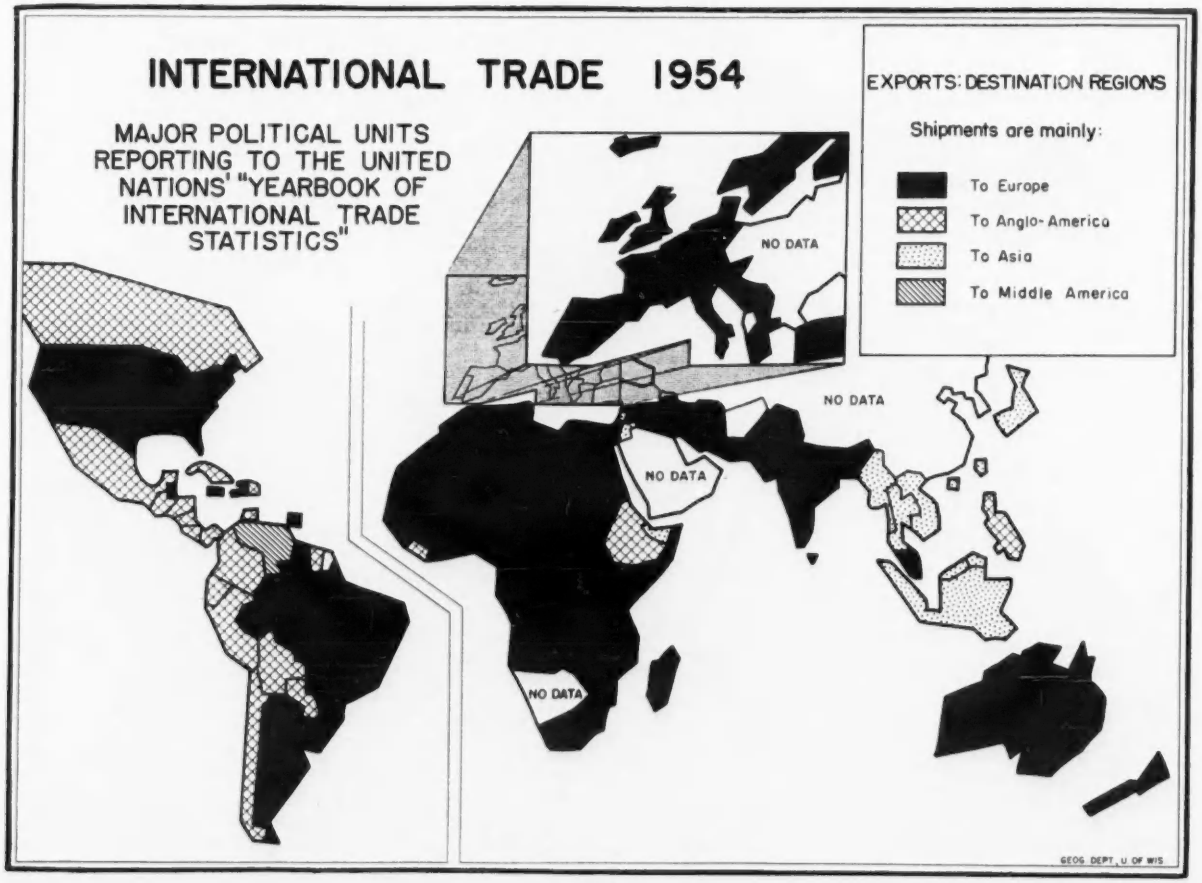
INTERNATIONAL TRADE 1954
MAJOR POLITICAL UNITS REPORTING TO THE UNITED NATIONS' "YEARBOOK OF INTERNATIONAL TRADE STATISTICS"
EXPORTS: DESTINATION REGIONS
Shipments are mainly:
To Europe
To Anglo-America
To Asia
To Middle America
NO DATA
NO DATA
NO DATA
NO DATA
GEOG. DEPT., U. OF WIS.

FIG. 3.

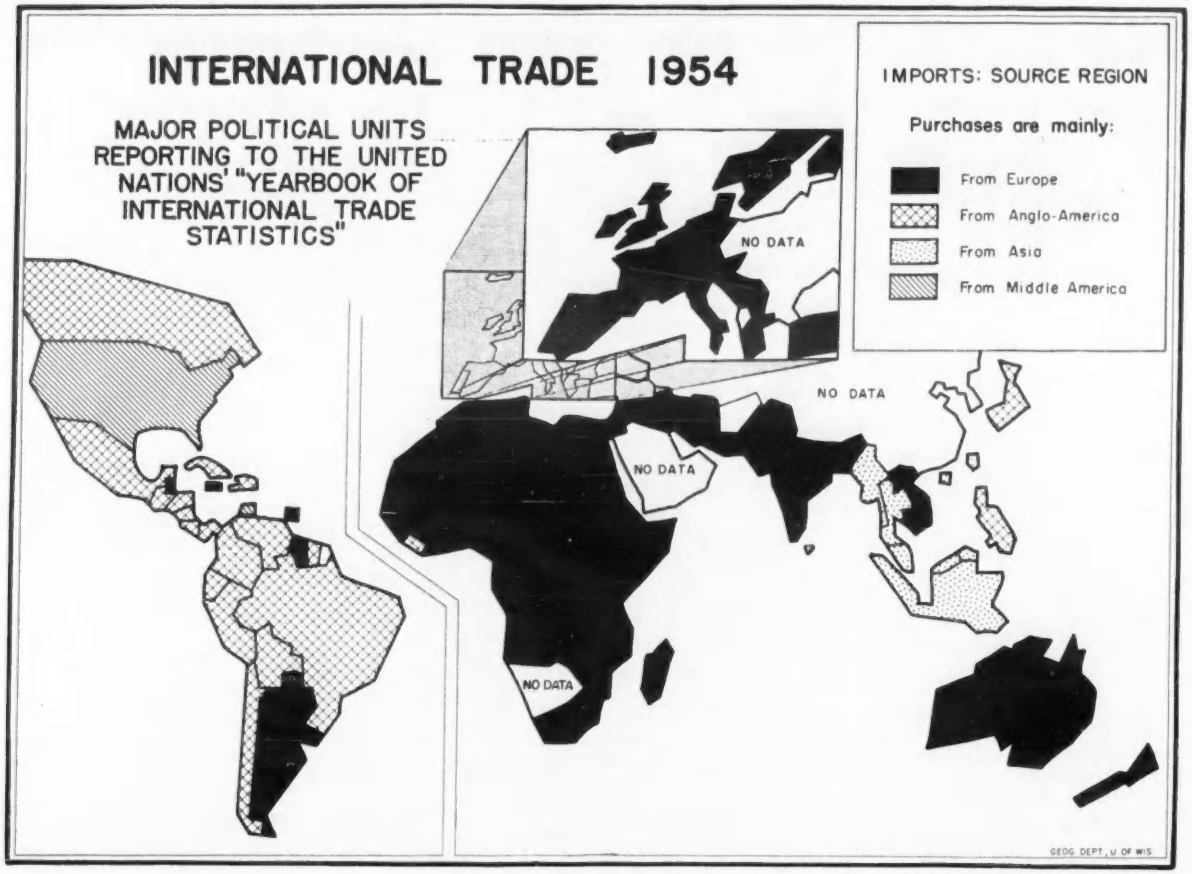
INTERNATIONAL TRADE 1954
MAJOR POLITICAL UNITS REPORTING TO THE UNITED NATIONS' "YEARBOOK OF INTERNATIONAL TRADE STATISTICS"
IMPORTS: SOURCE REGION
Purchases are mainly:
From Europe
From Anglo-America
From Asia
From Middle America
NO DATA
NO DATA
NO DATA
NO DATA
GEOG. DEPT., U. OF WIS.

FIG. 4.

United Kingdom is leading source for 29 nations.

Anglo-America is the main shipper to most countries in both North America and South America. Anomalous connections to distant regions involve Liberia, Japan, Philippines. Asia is leading source for several political units located in southeast Asia. The United States imports more from Middle America than from any other region.

Not a single country reports either Africa or Southern Hemisphere America or Australia–New Zealand as leading seller.

Perusal of Columns 5 and 6 in Table I indicates that 73 of the 98 countries have the same nation as their leading trade partner for both exports and imports. The United Kingdom, leading recipient of 29 nations' exports and leading supplier of 29 nations' imports, is the world's leading trading partner.

Eleven countries report the same trading region, but different trading nations as their leading export and leading import partners. One out of every six nations, however, imports mainly from one region and exports largely to another. This group includes some "processing countries" such as Netherlands Antilles and Malaya which import raw materials from adjacent nations and perform initial manufacturing processes in materials destined for Europe or America.

The United States exports most to western Europe yet buys most from Middle America; Brazil sells most to Europe, buys most from Anglo-America; Japan buys mainly from Anglo-America, sells mainly to Asia.

Figures 3 and 4 indicate that the world's major trading regions are related mainly with Europe for both exports and imports. Yet regions importing from Europe are less extensive than those exporting to Europe (especially in South America). Conversely regions importing from Anglo-America are greater than those exporting to Anglo-America. This is a major feature of the geography of international trade, fundamental to understanding the large negative trade balances noted earlier for Europe and the large excess of exports over imports for the United States. Similarly, Japan buys largely from the United States but is unable to reciprocate with equal sales of her surpluses. This, concomitant with Japan's severe export deficit (Table II), is a problem for American-Japanese diplomacy.

TABLE III

FREQUENCY OF NATIONS BY PROXIMITY OF TRADING PARTNERS

Percentage of foreign trade accounted for by neighboring nations	*Number of nations reporting their leading trade partner to be*	
	A neighbor	*Not a neighbor*
50 plus	7	0
25–49	12	7
10–24	1	20
Under 10	0	52

4. Regions by Proximity of Trading Nations

Proximity can be appraised in terms of (a) percentage of each nation's foreign trade accounted for by its neighbors and (b) whether or not its leading trade partner is a neighbor. Table III shows frequency of nations according to this twofold classification. (See Table I, Column 7 for classification of individual nations on this basis.)

One might expect countries to trade considerably with neighbors even though their major shipments were to and from Europe. But over half the nations report that less than 10 per cent of their trade is with neighbors, and only 20 say that their leading trading partner is a neighbor. Only seven nations do even half of their business with neighbors.

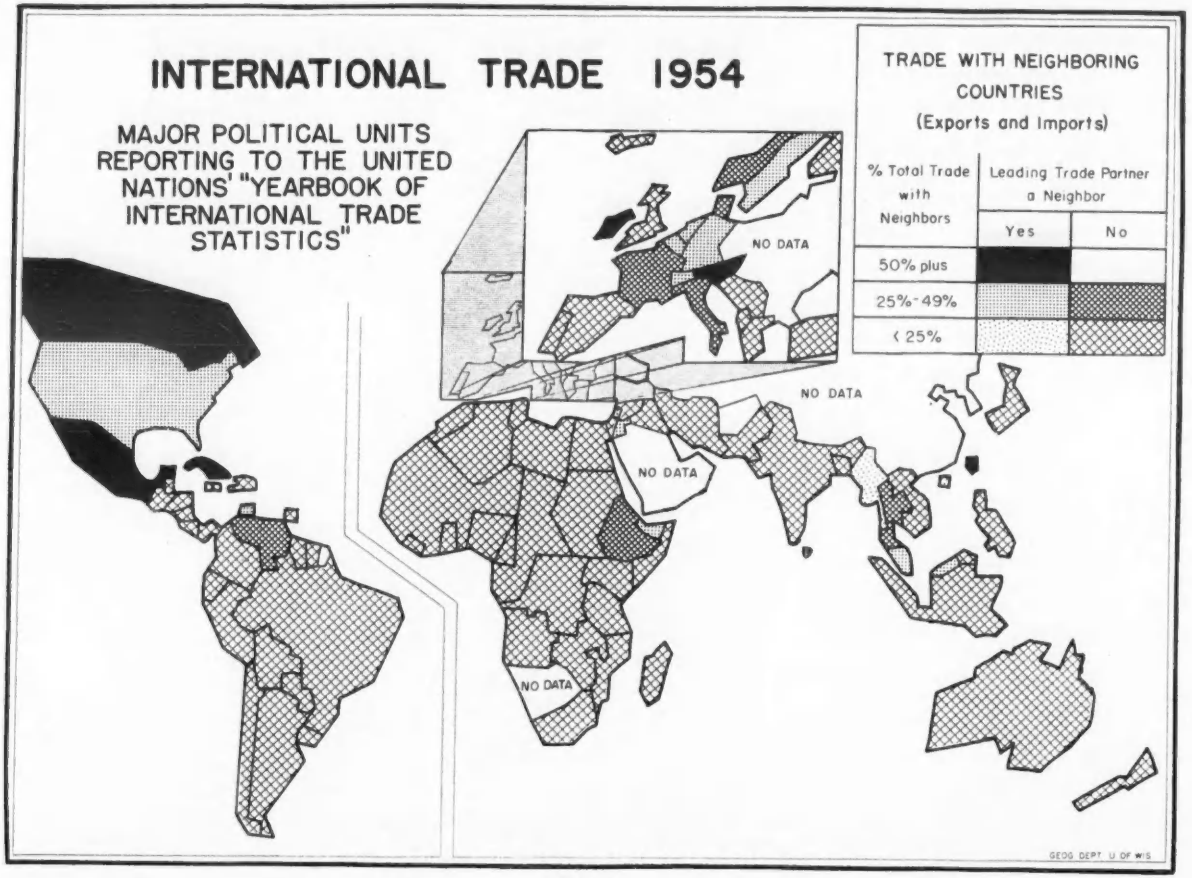
INTERNATIONAL TRADE 1954
MAJOR POLITICAL UNITS REPORTING TO THE UNITED NATIONS' "YEARBOOK OF INTERNATIONAL TRADE STATISTICS"
TRADE WITH NEIGHBORING COUNTRIES
(Exports and Imports)
% Total Trade with Neighbors
Leading Trade Partner a Neighbor
Yes
No
50% plus
25%-49%
< 25%
NO DATA
NO DATA
NO DATA
NO DATA
GEOG. DEPT. U. OF WIS.

FIG. 5.

Figure 5 shows that parts of North America, much of west-central Europe, and a few states in southeast Asia comprise three regions where nations trade considerably with those adjoining them. The rest of the world has a low proximity rating.

This leads to a fundamental geographic principle: *complementarity* is more powerful than *transferability* in the realm of international trade. *Complementarity* exists between two nations if one has a commodity surplus needed by another which *desires* and has the *purchasing power* to buy it from the surplus producer. *Transferability* is the cost (measured in time or money) of transporting the commodity between the two complementary regions.[2] Two striking examples of this principle are Australia and New Zealand which, farther than any other nations from Europe, still are linked to that region for 60 per cent and 74 per cent respectively of their international trade.

The power of complementarity is augmented by the role of political ties, of capital investments, and of migration movements in linking remote nations. Notice, for example, the linkage between Liberia and the Philippines with Anglo-America; of Australia, New Zealand, Netherlands Antilles, and British Honduras with Europe; and of many African states with Europe.

Interesting as Figure 5 and Column 7 (Table I) may be, however, one must use the proximity index with caution lest it be confused with *distance*. Belgium, though not a neighbor of Switzerland, is closer to that nation than are the developed portions of Brazil and Venezuela which are neighbors.

[2] The terminology "complementarity" and "transferability" for these concepts was suggested by Edward L. Ullman in *American Commodity Flow*, University of Washington Press, (Seattle, 1957), pp. 20–24.

5. Regions by Commodities Exported

Commodity data for 55 countries are organized by the United Nations as per the Standard International Trade Classification (SITC) adopted in 1952 recognizing ten major categories: food, beverages and tobacco, crude materials, mineral fuels, animal and vegetable oils, chemicals, manufactures, machinery, miscellaneous manufactures, and others. Information on commodities for remaining nations is listed in heterogeneous sequences preventing uniform comparison.

For regionalizing in this study, commodities were grouped into four classes: (1) foods (including beverages and tobacco), (2) crude materials (including mineral fuels, animal oils, and vegetable oils), (3) manufactures (including chemicals, and miscellaneous manufactures), and (4) machinery. The reason for such grouping is that foods and crudes typify exports from nations in early stages of economic development, manufactures typify a more complex stage, and machinery a still more complex stage.

The percentage of each nation's exports in each group was computed. Subsequent classification of nations on the basis of these percentages raised several questions. Suppose the exports from nation X were 37 per cent foods and 21 per cent machinery. Should nation X therefore be classified primarily as a food exporter? Or should her percentages be compared with some central value such as the world average? For example, the 55 nations comforming to the United Nation's Standard International Trade Classification, report foods as accounting for 38 per cent of all exports, machinery for 7 per cent. Compared to these central values, nation X exported three times as much machinery as the average but was actually below average in food export.

Should she therefore be classified primarily as a machinery exporter? Since, in her own economy, revenues from food shipments surpassed machinery sales, the author decided to appraise exports in terms of support of each nation's economy.

On this basis, each nation's category is identified in Table I, Column 8, by a series of lower-case letters, one for each commodity group (exceeding 25 per cent) listed in order of percentages. The code system is: *f*—foods, beverages, and tobacco; *c*—crude materials, mineral fuels, animal and vegetable oils; *m*—manufactures, chemicals; *y*—machinery. An apostrophe indicates at least 50 per cent of exports.

The cartogram (Fig. 6) reveals four broad types of regions, distinguished by exports of: (1) foods, (2) crude materials, (3) manufactures, (4) manufactures and machinery.

Several areas are mainly *food* exporters. Middle America and eastern South America report the highest percentage of food exports in the world, climaxed by Costa Rica's 98 per cent; bananas, sugar, coffee, and grains are major commodities moving out from this region. In smaller European countries foods comprise over 75 per cent of exports: Iceland (fish), Ireland (animals and meat), Denmark (meat and dairy products). Equally high percentages occur in the Far East: Burma and Thailand (rice) and Taiwan (tea). Several African countries on the western and eastern portions of the continent are in this category. Wherever foods are the leading export, two principles prevail: (a) they invariably exceed all other exports combined (i.e., rarely do foods rank first without rating 50 per cent) and (b) the runner-up invariably is crude materials. Examples are Brazil and Argentina (coffee and meats followed by cotton and wool), eastern Mediterranean countries (fruit, wheat, cotton), and New Zealand (dairy products, meat, wool).

Sales of *crude materials* dominate commodity revenues in three general areas. From South Africa northward through the middle of the continent and eastward to Pakistan is an arcuate region from which flow minerals (copper, petroleum) and fibers (cotton, jute). From Mexico through Venezuela and southward to Chile is a similar belt generating surplus minerals (e.g., petroleum, bauxite, tin, copper) and cotton. A third general area is southeast of Asia: Malaya, Philippines, Indonesia, and Australia. Many countries depend upon crude materials for an extremely high share of their exports: Venezuela, Surinam, and Bolivia, all above 95 per cent; Egypt, Tanganyika and Rhodesia, above 75 per cent. Wherever crude materials rank first, two principles appear: (a) they tend to comprise over half the exports, and (b) where a second commodity ranks as high as 25 per cent, it invariably is foods. Examples of such areas are Australia (wool, meat, grains), Indonesia (rubber, tin, copra, coffee), the Philippines (copra, sugar), South Africa (wool, fruit).

Manufactures rank first in three familiar regions: western Europe, Anglo-America, and Japan. India is now in this category: although her leading item is tea (25 per cent), the combination of two lesser manufactures (jute and cotton textiles) gives manufactures a slight margin.[3] In regions where manufactures are the leading export, they never attain the maximum percentages reached by foods and crude materials; the highest percentages occur in United Kingdom (88 per cent), West Germany (86 per cent) and Japan (85 per cent). Fre-

[3] If copper concentrate be considered a manufactured item, Rhodesia and Belgian Congo qualify.

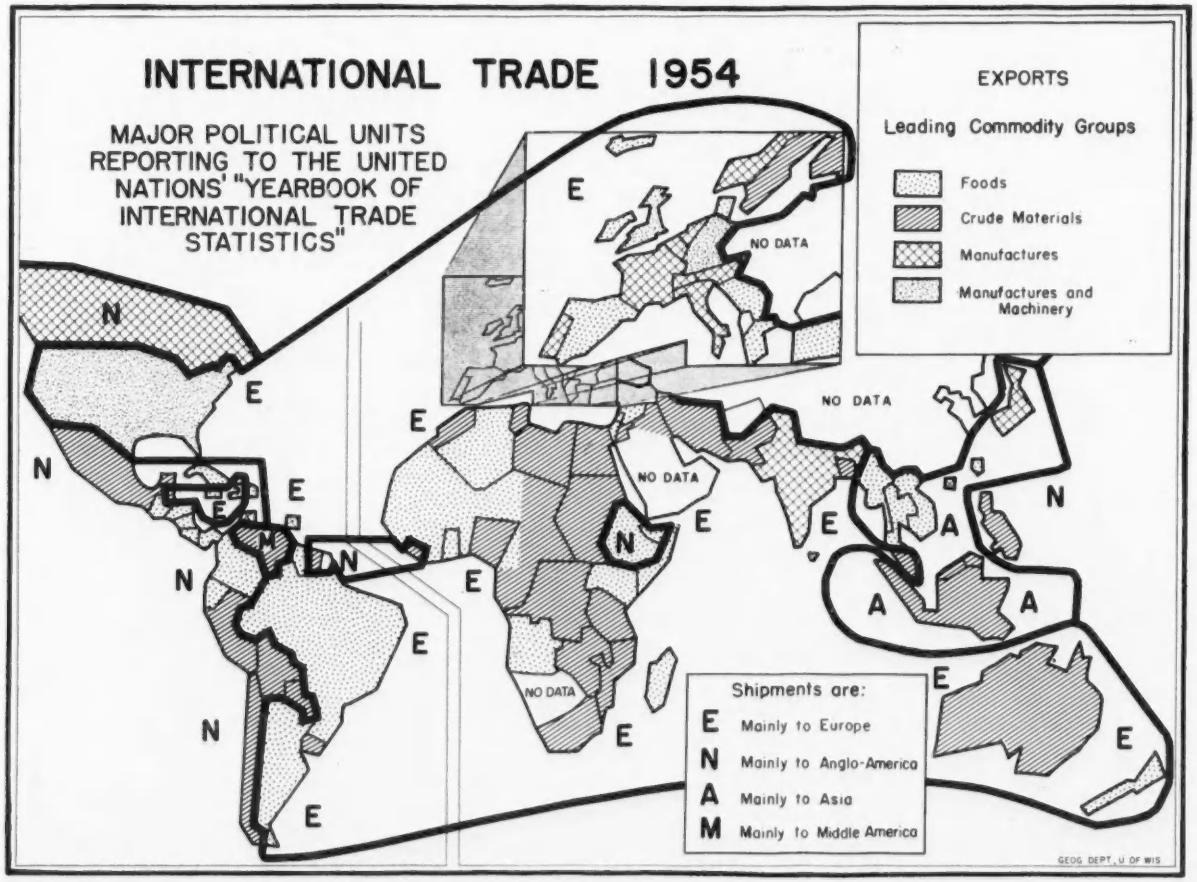
INTERNATIONAL TRADE 1954
MAJOR POLITICAL UNITS REPORTING TO THE UNITED NATIONS' "YEARBOOK OF INTERNATIONAL TRADE STATISTICS"
EXPORTS
Leading Commodity Groups
Foods
Crude Materials
Manufactures
Manufactures and Machinery
NO DATA
NO DATA
NO DATA
NO DATA
Shipments are:
E Mainly to Europe
N Mainly to Anglo-America
A Mainly to Asia
M Mainly to Middle America
GEOG. DEPT., U. OF WIS.

FIG. 6.

quently, manufactures rank first with less than 50 per cent of exports: United States 38 per cent, Canada 40 per cent, Netherlands 40 per cent, Norway 41 per cent. Also, there is not a close correlation between manufactures and the "runner-up" as was found for foods and crudes; sometimes the second ranking export is crude material (wood, second to paper from Canada), food (fish, second to pulp and paper from Norway), or machinery (second to general manufactures from United States, and United Kingdom). Another principle is that large volumes of trade correlate with exports of manufactures; all nine nations participating in $4,000,000,000 or more of trade (Table I, Column 4) have manufactures as the leading export (Column 8).

There is no region where *machinery* is the leading export. In three nations it ranks high (40 per cent Germany, 37 per cent United Kingdom, 35 per cent in United States) but in each case it is exceeded by other manufactures. A principle seems to hold that if machinery is a major export (representing at least 25 per cent of the outbound flow) it will be exceeded by other manufactures, and foods and crudes will be relatively minor exports.

The heavy lines on Figure 6 show regions in terms of leading consignees based on Figure 3. The "food-to-Europe" region is widely distributed through South America, Africa, and peripheral nations of Europe itself. New Zealand, half way around the globe, belongs to this type. Almost as widespread is the "crudes-to-Europe" region which occurs mainly in Africa, southern Asia, and Australia. Finland and Sweden belong. The area distinguished by "manufactures-to-Europe" is restricted to European nations except for the United States, Trinidad (petroleum products), and India (jute). Fully two-thirds of the world's free countries belong to the foregoing triad of European regions.

The "food-to-Anglo-America" area occupies Middle America with an outlier in Africa (Ethiopia—coffee). More extensive is the "crudes-to-Anglo-America" region of western South America, Mexico, Liberia, and the Philippines. Canada is the sole nation tied to Anglo-America mainly by manufactures (paper) shipments.

In the Far East, mainland nations tend to be "food-to-Asia" shippers while the islands are in the "crudes-to-Asia" class. Japan and Hong Kong are the only units in the "manufactures-to-Asia" region. Malaya and the Philippines are anomalies: both are in the crude material group, but the former sells mainly to Europe, the latter to Anglo-America.

6. Regions by Commodities Imported

The classification system explained above for exports was applied to import traffic (Table I, Column 9) which is mapped on Figure 7. Four general regions are discernible. Most extensive is that receiving *manufactures:* much of Africa, southern Asia, the United States, several units of Central America, and peripheral European nations (e.g., Ireland, Portugal, Greece, Sweden). Notice the prominence of textiles in Column 9 of Table I; 37 countries report it as the leading item purchased abroad. Regions classed as receivers of *manufactures and machinery* include much of North America, South America, central Africa, and Australia–New Zealand. Might there be a correlation here between present rate of economic advancement and this type of import structure? *Crude materials* comprise the major inflow to only a few countries, most of which are manufacturing countries of Europe, and Japan. The absence in

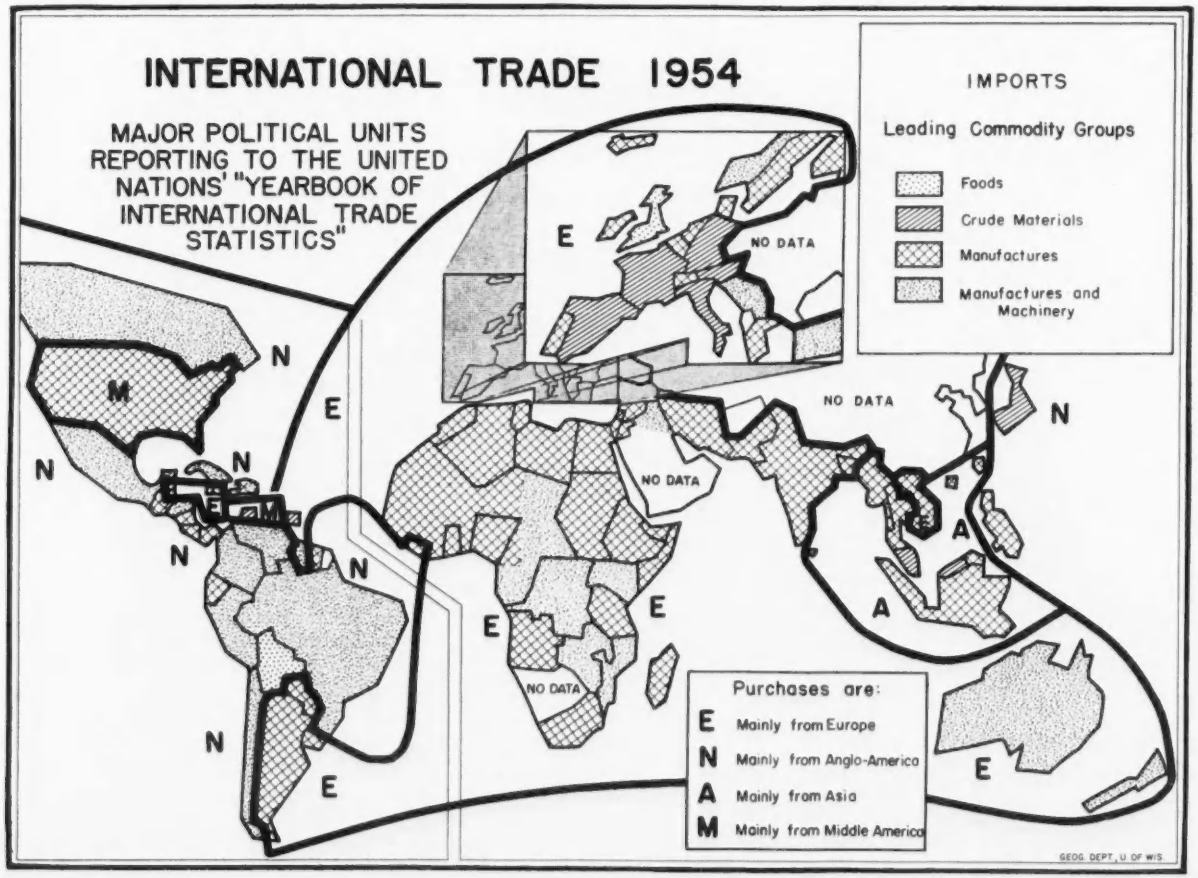
INTERNATIONAL TRADE 1954
MAJOR POLITICAL UNITS REPORTING TO THE UNITED NATIONS' "YEARBOOK OF INTERNATIONAL TRADE STATISTICS"
IMPORTS
Leading Commodity Groups
Foods
Crude Materials
Manufactures
Manufactures and Machinery
NO DATA
Purchases are:
E Mainly from Europe
N Mainly from Anglo-America
A Mainly from Asia
M Mainly from Middle America
GEOG. DEPT., U. OF WIS.

FIG. 7.

this category of the United States is somewhat surprising. Very few areas are primarily *food* importers.

Commodity groups never attained as high maximum percentages of imports as of exports; the highest proportion attained by inbound food was 40 per cent (United Kingdom), crudes 82 per cent (Netherland Antilles—crude oil from Venezuela), manufactures 70 per cent (Burma), and machinery 43 per cent (Mexico). Thus, the international trade picture of 1954 was distinguished by import structures much more diversified than those of exports.

The heavy lines on Figure 7 show regions in terms of leading source of imports. The dominant region ("manufactures-from-Europe") occurs on every continent, covering practically all of Africa, southern Asia, fringing nations of Europe itself, and a few countries in the Americas. Included are 46 of the 98 trading units. The "machinery-manufactures-from-Europe" region contains 12 countries, mostly in Africa and Australia–New Zealand. The "crudes-from-Europe" category has five entries, all in central Europe. A dozen units comprise "manufactures-from-Anglo-America" type and are mostly in Middle America. The "machinery manufactures-from-Anglo-America" region comprises much of South America, Mexico, and Canada. The "import-from-Asia" region is entirely within southeast Asia where imports are largely manufactures from Japan.

Comparison of Columns 8 and 9 in Table I enables construction of a frequency tabulation (Table IV) which indicates that two well-known principles continue to operate: (1) if a nation's export category is foods-crudes (*f*, *c*, *fc*, *cf*) its *import* category is likely to be manufactures (*m*, *my*, or *ym*); 66 of 80 countries conform with this rule. (2) If a nation's *import* category is manufactures (*m*, *my* or *ym*) its *export* category will be foods-crudes (*c*, *f*, *cf*, *fc*); 66 of 73 places support this generalization. Notice the frequency with which textiles, as the leading import, correlates with bananas, sugar, coffee, cotton, wood, as leading export (Table I, Columns 8 and 9).

TABLE IV

FREQUENCY OF NATIONS BY COMMODITIES: EXPORTS AND IMPORTS, 1954

Import classification	*Export classification*				
	c, f, cf, fc	*cm, fm*	*mc, mf*	*m, my*	*Totals*
c, f, cf, fc	2	0	0	6	8
cm, fm	3	1	1	0	5
mc, mf	9	0	0	4	13
m, my, ym	66	2	4	1	73
Totals	80	3	5	11	99

The novice might think that the opposite principle would hold; viz., that if a nation's *exports* are manufactures (*m* or *my*) its *import* classification will be foods or crudes. However, only six of 11 countries support this theory. The generalization does hold for United Kingdom, Germany, France, Italy, Japan, and Netherlands Antilles. But there are almost as many exceptions: United States, Belgium, Switzerland, Hong Kong, and Trinidad.

Table IV indicates that there are several nations with a rather unusual export-import structure. Two places are in the crude-food category for *both* exports and imports: Malaya imports oil, rubber, and food and exports tin and even more crude rubber. Sarawak's imports are mostly crude oil; her exports are largely crude oil and pepper. At the other extreme is Switzerland which is in the manufactures category for *both* exports and imports; in-movements of steel and machines are countered by out-movements of clocks, watches, and textiles. Many nations

report a "mixture" of commodities (i.e., both manufactures and foods-crudes appear in the classification symbol). Twelve countries have a mixed flow of imports while exporting foods and crudes. In general, these are rather sparsely populated areas where the economy is in the early stages of development (e.g., Bolivia, Libya, North Borneo, Lebanon, Jordan, and the Sudan). Four countries have a mixed flow of imports countered by outflows of manufactures (United States, Belgium, Trinidad, and Hong Kong). Six countries have diverse exports, while importing manufactures: Norway, Sweden, Finland, Portugal, India, and Canada. Mixtures in both inbound and outbound flows distinguish Netherlands and Austria.

The generalization seems to hold that a mixture of commodities is more typical of imports (18 countries in Table IV) than of exports (eight countries).

7. Regions by Exports (Destinations and Commodities) and Imports (Sources and Commodities) and Balance

Figure 8 is an attempt to regionalize nations by a single system combining several criteria: commodities exported, consignees, commodities imported, sources, and net balance. Four major regions appear: *A* (linked to Asia by both inflow and outflow), *E* (involved with Europe in both flows), *N* (receiving from and shipping mainly to Anglo-America), and *X* (linked by exports to one region and by imports to another).

Region E is by far the most expansive, appearing on all continents and covering the entirety of Europe, practically all of Africa, southern Asia, Australia–New Zealand, portions of South America, and a few units in North America. Moreover, every country in Region X (except Japan) is involved mainly with Europe. Most of this European region is of the "colonial" type, i.e., exporting foods and crudes in return for manufactures; however, India and most countries of Europe show manufactures as the ranking export. Within Europe, an "inner core" of United Kingdom, France, Italy, and Germany exemplify the traditional exporter of manufactures in return for crudes and foods. The few small nations in this ring (Belgium, Netherlands, Switzerland) report manufactures leading in both receipts and shipments. Does this support a hypothesis that small nations with large numbers of skilled people but limited natural resources tend toward a trade pattern featuring imports of semi-processed manufactures which are processed to a higher form and then exported? An "outer ring" (Ireland, Iceland, Sweden, Finland, and Yugoslavia) are "colonial" with a surplus of foods-crudes but a deficit in manufactures.

Most of Region E is a "debtor" area insofar as visible trade is concerned; i.e., imports exceed exports. This does not mean that a debtor nation is en route to bankruptcy, but it does mean that she must devise other means of augmenting her income (e.g., tourism, foreign investments) to pay for the debt incurred through her unfavorable balance in commodity trading. Indeed, all European nations themselves (except Germany and Finland) have a trade deficit, with the United Kingdom's deficiency (an astounding $1,600,000,000) exceeding by far that of any other nation (Table II). The combined deficits of Japan ($770,000,000) and Italy ($765,000,000) do not equal the United Kingdom's.

The Anglo-American Region, *N*, is restricted to the Western Hemisphere (except for Liberia and the Philippines) and includes every North American country except the United States, Jamaica, Haiti, British Honduras, and Guadeloupe. This is another "colonial"

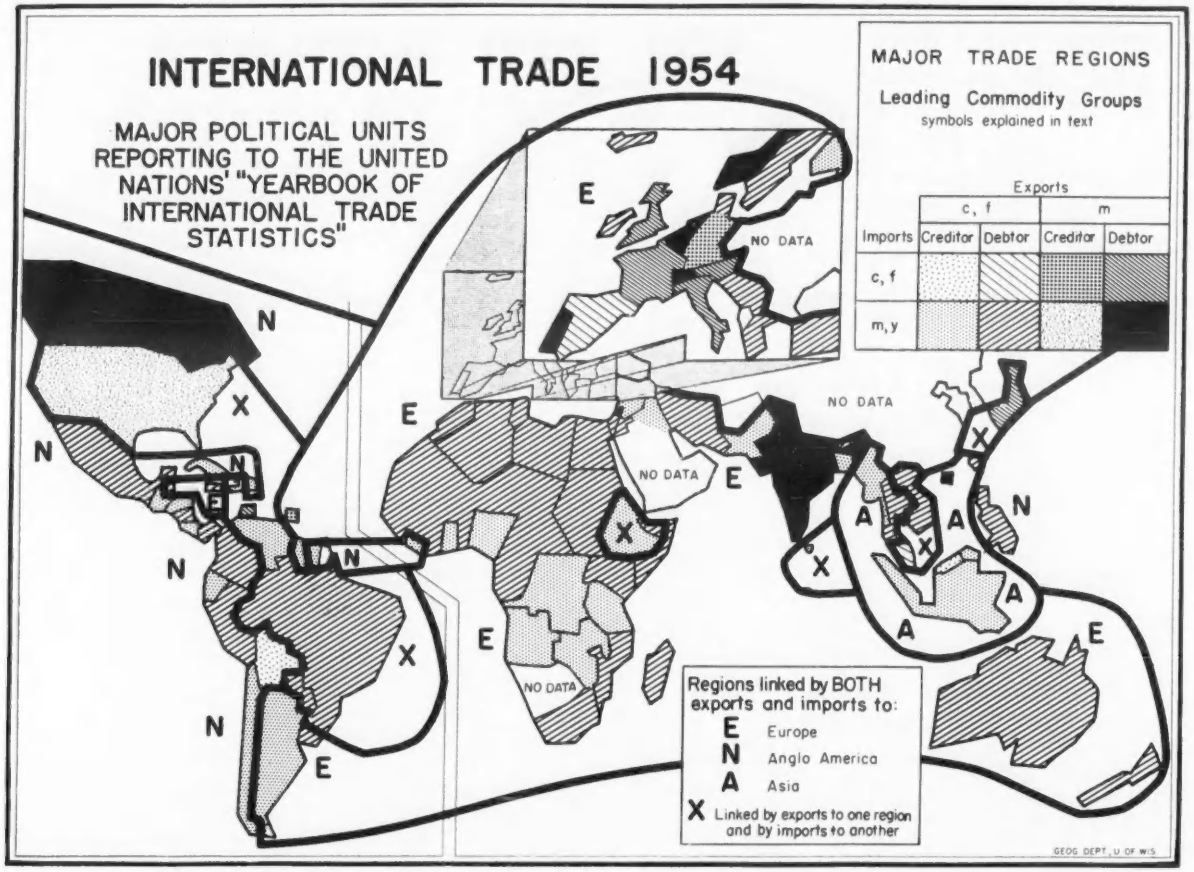
INTERNATIONAL TRADE 1954
MAJOR POLITICAL UNITS REPORTING TO THE UNITED NATIONS' "YEARBOOK OF INTERNATIONAL TRADE STATISTICS"
MAJOR TRADE REGIONS
Leading Commodity Groups
symbols explained in text
Exports
Imports
c, f
m
Creditor
Debtor
Creditor
Debtor
c, f
m, y
NO DATA
NO DATA
NO DATA
NO DATA
Regions linked by BOTH exports and imports to:
E Europe
N Anglo America
A Asia
X Linked by exports to one region and by imports to another
GEOG DEPT. U OF WIS

FIG. 8.

trade region excepting Canada (with mixed exports) and Bolivia (whose imports are dominated by foods). Many nations in this region have a "favorable" balance.

The Asian Region, *A*, is another "colonial" trade area, and is restricted to small traders of southeast Asia. All but one have "favorable" balances and do major business with Japan, a fact which sheds additional light on the problem of that nation.

Two large traders of the Far East, Malaya and Japan, are in Region *X*, the former buying from Asia and selling to Europe (another factor in the European deficit) while Japan sells mainly to Asia and purchases from the United States (a factor in the United States problem of excess exports and Japan's problem of excess imports).

A major reason for Europe's trade problem is that the United States is in Region *X*, selling to Europe but buying mainly from Middle America.

FURTHER QUESTIONS

The present study has been based on data for only one year. Were its methods applied to a longer time period, would different findings result? That is, are annual fluctuations in international trade so capricious that a one-year glimpse produces fallacious conclusions?

To what extent would Figures 3 and 4 show a different pattern if they had been constructed on the basis of leading source *country* of imports and leading destination *country* for exports?

What would be the pattern of a world map of trade imbalance constructed to show debtor nations in terms of countries they owed and creditor nations in terms of countries owing them? Are any regions discernible in terms of methods used by debtor nations to augment their incomes?

PROJECTIONS OF INTERREGIONAL PATTERNS OF TRADE IN WHEAT AND FLOUR

Richard L. Morrill and William L. Garrison

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WHEAT and flour are known to move in large volumes from region to region in the United States. Knowledge of this trade stems from many bits of particular information on topics such as the location of flour mills and the location of wheat production, and from general information, such as the notion of comparative advantage. Statistics are not available, however, which would allow direct mapping of interregional patterns of trade. In the present paper, the question is asked: to what extent can patterns of trade in wheat and flour be *projected* from available techniques and information?

Certainly, the most general thing known about trade is that the location of production and the location of trade flows are determined simultaneously: production is determined by possibilities for trade and trade is determined by the location of production (and consumption). But in the case of a resource-based activity such as the production of wheat and subsequent milling of flour, it is known that variations in natural resources exert a profound effect on the location of production. Too, it is known that the location of the ultimate market is not greatly influenced by the location of wheat production. So, in the short run, our general information about trade in wheat and flour allows us to take resources, production patterns, and ultimate markets as given. Concern is chiefly with the balance of flows between production regions, processing mills, and market regions.

The term "comparative advantage" has been used as a succinct explanation of problems of trade flows, but usual elaborations of comparative advantage do not completely describe the present problem. Usual statements of comparative advantage refer to two commodities exchanged between two locations. In the wheat and flour case, concern is with the flow of a basic commodity and one of its products among many locations. For another thing, discussions of comparative advantage usually ignore transportation costs between locations, and specific recognition of transportation costs is extremely important to the present trade formulation.

In this study, the concept of spatial equilibrium is used to project trade patterns. The concept treats trade as an outcome both of regional differences and transport costs among regions, and brings together bits of information observed from place to place, in order to project movements of wheat and flour. In the first portion of this

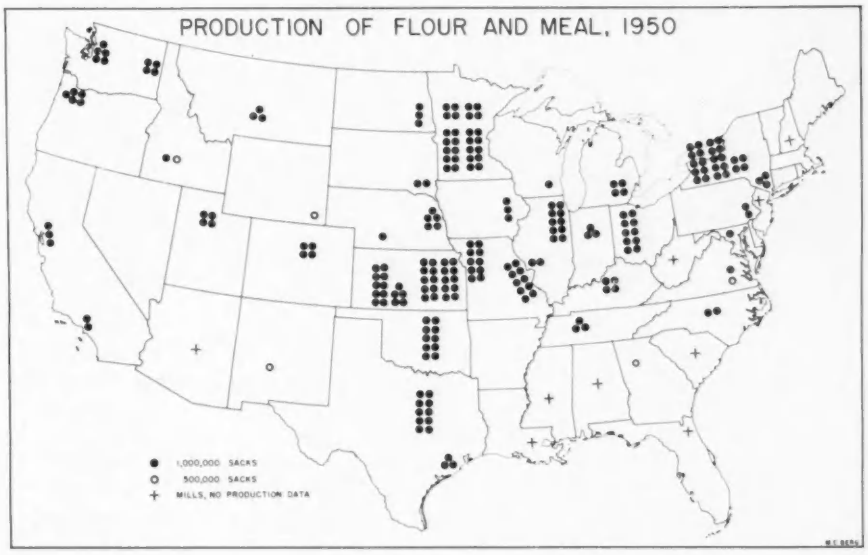

FIG. 1.

paper, the pattern of movement of wheat and flour in 1954 is constructed. Adequacy of this approach is next judged by a comparison with available empirical information. Finally, uses of this concept are suggested by postulating changes in the production and market characteristics of the wheat and flour industry, and noting resulting changes in trade. The paper as a whole provides a statement, illustration, and partial evaluation of recent analytic developments of trade flow analysis.

TRADE IN WHEAT AND FLOUR

Wheat is produced on farms and then, unless held for seed or other on-the-farm uses, is shipped for export, or shipped to domestic flour mills, or stored, or disposed of in other ways. Trade results from imperfect coincidence between the farmers producing wheat and the location of users. In the remainder of this paper we consider only that wheat which moves to flour mills and then to domestic flour markets.

Briefly, flour milling utilizes about one-half of domestic wheat production. Flour mills have characteristically located at sites intermediate between places of wheat production and places of flour consumption. Prior to 1925, the Northwest, principally Minnesota, was the center of flour milling. In succeeding years, freight rate changes favoring shipment of wheat in preference to flour via the Great Lakes, the utilization of Southwest winter wheat in flour manufacture, and shifts in the market, including per capita decreases in flour consumption along with increased consumption of bakery products, have resulted in the growth of the milling industry in a number of centers (Fig. 1).

Interregional projections of trade in wheat and flour are shown on Figure 2. Trade is shown by arrows between the regions shown using regional boundaries. The first map shows the flows necessary to bring wheat produced to meet demands at flour mills. The

second map shows those flows necessary to bring flour production to meet demands by ultimate consumers. The maps also show the prices resulting from the patterns of trade. At first glance, the reader might feel that these regions are somewhat less than ideal. They are, but the difficulty of making and checking trade projections required use of rather gross regions. (However, these are regions for which certain I.C.C. data are available.)

The Projection Problem

At first glance, it might appear that establishing the patterns of trade from basic information on surplus and deficits would be a simple matter. However, there are complicating factors. For one, there is some reason to believe that patterns of trade are efficient ones: of all possible ways that flows might be constructed, the pattern of flow is that which results in the least total transportation cost. This might come about either because producers and shippers consciously attempt to ship to markets via least cost routes, or it might come about because those shippers who have survived are efficient, whether they are conscious of it or not.[1]

Another complicating aspect of the problem is the set of price relationships which must exist for trade to take place. Prices in excess regions must differ from those in deficit regions by an amount at least equal or greater than transportation costs between regions, or trade will not flow. But prices are a function of supply. As shipments occur, supplies in excess regions decrease, and prices shift upwards. In deficit regions, supplies increase and prices shift downward. The manner in which prices shift affects paths of trade, and these price shifts must be considered.

The general intelligence just discussed in the paragraph above leads to the following summary of considerations entering into trade projections:

1. Trade will take place between regions if the difference between regional prices is greater than the amount of transportation cost between them.
2. The amount traded between regions will be that required to shift prices through supply and demand relationships until prices are separated by the interregional transportation costs.
3. Consumption in all regions must equal the total amount produced. This statement may seem somewhat foreign to earlier observations. But remember that this

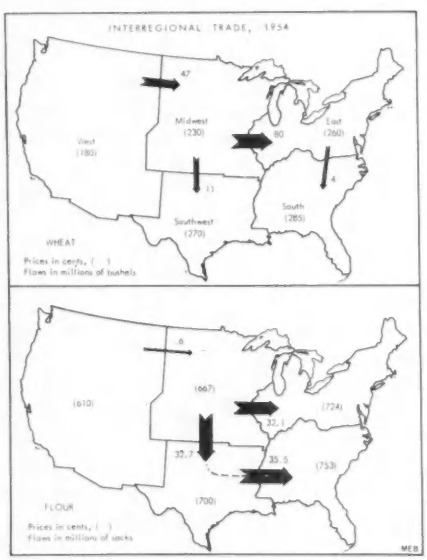

FIG. 2.

[1] Under perfect competition interregional price relationships among regions would sustain the efficient pattern of flows. For an economic interpretation of a commodity flow problem see James M. Henderson: *The Efficiency of the Coal Industry: An Application of Linear Programming* (Harvard University Press, Cambridge, 1958), pp. 1–12.

discussion of trade is in the short-run; it is presumed that production has balanced with consumption due to long run location changes. Concern here is strictly with the trade paths by which production is merged with consumption.

4. Patterns of trade are efficient in the sense that transportation costs are at a minimum.

The problem revealed by the summary statements above has been the subject of several studies other than the present study. The first statement of the problem known to the authors is due to Enke, who achieved a solution using an electric analogue.[2] Enke considered several hypothetical regions trading a good, each region constituting a distinct market, and each separated from other regions by transportation costs. In each region, the functions which relate local consumption and production to local price are known. Consequently, it is known how a magnitude of imports or exports will vary local prices. The objective is to find a direction of all trade between regions and the resulting set of prices. Enke's solution of the problem was by an electric analogue in which regional differences of supply were represented by initial voltage differentials at sinks and transportation costs by resistances, current flows at equilibrium represent equilibrium conditions. P. A. Samuelson has provided a general discussion of this model.[3]

Fox and Taeuber worked out a numerical solution for a trade problem, and their work together with work by others in the field provides a numerical rather than an analogue solution to the problem.[4] The problem provided by these researchers is used as the basis for the work done in the present analysis.

A Miniature Example

A simple example will serve to illustrate the problem at a numerical level. Imagine two regions, A and B, with some good traded between them. A is the surplus region and B is the deficit region. In the absence of trade, the price for the good would be low in A and high in B, following the equation:

$$P = 300 - 2C.$$

In this equation, C is the amount consumed and P is the regional price. This equation holds in both regions.

The condition in each region before trade begins is as follows:

A	B
100 units	25 units
$1.00 unit	$2.50 unit

Trade will take place if the transportation costs between A and B are low enough, say $.50 per unit, for producers in A to sell to B at a higher price than they can get locally. Trade will continue until the supply at B is large enough so that the spread in price between A and B is equal to the transportation costs between A and B. After trade, supplies and prices are:

A	B
75 units	50 units
$1.50 unit	$2.00 unit

Spatial equilibrium is reached after 25 units are moved from A to B.

[2] Stephen Enke: "Equilibrium among Spatially Separated Markets," *Econometrica*, Vol. 19, 1951, pp. 40–47.

[3] P. A. Samuelson: "Spatial Price Equilibrium and Linear Programming," *Amer. Econ. Rev.*, Vol. 42, 1952, pp. 283–303.

[4] Karl A. Fox: "A Spatial Equilibrium Model of the Livestock-Feed Economy of the United States," *Econometrica*, Vol. 21, 1953, pp. 547–566. Karl A. Fox and Richard C. Taeuber: "Spatial Equilibrium Models of the Livestock-Feed Economy," *Amer. Econ. Rev.*, Vol. 40, 1955, pp. 584–608. For a more complete review of the literature, see R. L. Morrill: *An Experimental Study of Trade in Wheat and Flour in the United States.* (Unpublished M.A. Thesis, University of Washington, 1957.)

It is instructive to compare commodity values from the before case to the after case.

After Trade

A. 75 units at \$1.50/unit = \$112.50
B. 50 units at \$2.00/unit = \$100.00

Transportation Costs

25 units at \$ .50 per unit = \$12.50

Before Trade

A. 100 units at \$1.00/unit = \$100.00
B. 25 units at \$2.50/unit = \$ 62.50

The net pay-off from having trade is the after trade value of the commodity less the before value and transportation costs, or \$37.50.

This sample illustrates an important characteristic of the problem. Not only are efficient flow patterns projected, but there is a measurement of the value, here called net pay-off, of increased trade. The latter problem is emphasized in another study by the authors.[5]

DATA USED IN THE STUDY

This study recognizes two levels of trade equilibrium: the shipment of flour from mills to bakeries and other consumers, and the shipping of wheat to mills. A set of data on three subjects was required for each study, namely: supplies available, demand conditions, and transport costs between all pairs of regions.

Wheat

A major problem in the work with trade patterns is knowledge of demand conditions. Basic to the present study is an expression of the final demand for the various uses of wheat.[6] The equation given below expresses the demand for wheat for flour by flour mills.

$$C_w = K(1.00 - .00054P_w + .00053\frac{D}{L} - .0101T - .00396M)$$

in which:

C_w —Consumption of wheat
K —Flour mill capacity (in millions of bushels of wheat)
L —Population
P_w —Domestic wheat price
D —Disposable income
T —Time (1921 = 1)
M —Average hourly wage rate

This equation states that increases in price or time, or average hourly wages, have small but depressing effects upon wheat consumption, while rising per capita income has a positive effect. The coefficient associated with the time variable, for example, shows the gradual per capita decline in use of flour as a food. Hourly wages are used as an equivalent to a price index for bakery goods and take into account the effects of price levels on consumption. Rising per capita income permits the purchase of greater quantities of wheat, as well as the substitution of bread for potatoes and corn, but this has been more than offset by the opposite effects of the other variables over time. Basic data fitted into this equation are given in a table (Table I).

A second requirement for the equilibrium solution was interregional transport costs. Railroad rates were available from the Interstate Commerce Commission,[7] but these are of limited use since almost 60 per cent of wheat in interstate commerce moves by water rather than by rail.[8] Rates over water

[5] W. L. Garrison, Brian J. L. Berry, Duane F. Marble, John D. Nystuen, and Richard L. Morrill: *Studies of Highway Development and Geographic Change*, University of Washington Press, Seattle, 1959.

[6] This equation is from a study by Kenneth Meinken: "The Demand and Price Structure for Wheat," USDA, *Technical Bulletin* No. 1136, November, 1955, pp. 36–52.

[7] Interstate Commerce Commission, *Carload Waybill Statistics*, 1954. Territorial Distribution: Traffic and Revenue, by Commodity Classes.

[8] U. S. Army Corps of Engineers, *Water-Borne Commerce of the United States*, 1954 and 1955. Washington, D. C.

TABLE I

DATA FOR THE WHEAT PROBLEM

	Northeast	*Midwest*	*South*	*Southwest*	*West*	*United States*
Wheat production (mi. bu.)	198	408	24	105	235	970
Other uses (mi. bu.)	120	163	15	69	123	490
Supply for flour (mi. bu.)	78	245	9	36	112	480
Flour mill capacity (K) (mi. bu.)	185	270	19	75	85	634
Per/capita income (D/L) (dollars)	1,980	1,648	1,350	1,438	1,906	1,770
Hourly wage rate (M) (cents)	188	175	141	166	203	181
Population (L) (mi.)	74.5	18.3	34.7	15.2	22.5	166

Sources: U. S. Dept. of Agriculture, Agricultural Statistics, 1955; U. S. Bureau of the Census, *Census of Manufactures*, 1954, Advanced Reports, MC-20-4.4, "Flour and Meal Industry," 1956 and MC-20-4, "Grain Mill Products," 1956; and Kenneth Meinken: "Demand and Price Structure for Wheat," *Technical Bulletin*, 1138, U. S. Dept. of Agriculture, 1955.

are considerably lower than competing railway rates. Consequently, interregional costs were lowered in three cases: from the Midwest to the Northeast, via the Great Lakes; and from the Midwest to the Southwest and the Southwest to the South, over the Mississippi River System. Estimated transport costs between regions are given in an accompanying table (Table II).

TABLE II

INTERREGIONAL WHEAT TRANSPORTATION COSTS*
(cents per bushel)

	Northeast	*Midwest*	*South*	*Southwest*
Midwest	30	..	..	..
South	25	70	..	..
Southwest	70	40	40	..
West	90	50	90	70

*Costs are for distances between the centers of regions.
Sources: Interstate Commerce Commission, United States, *Carload Waybill Statistics*, 1954. "Mileage Block Distribution-Products of Agriculture," Statement MB-1, 1954, Washington, D. C., 1955, and "Territorial Distribution and Revenue by Commodity Classes," Statement TD-1, 1954.

Flour

The equation for flour is similar to the equation for wheat presented earlier. The only differences are the substitution of the flour equivalent for wheat used for flour and flour price for wheat price. The first is an exact relation, where 2.33 bushels of wheat are equivalent to one cwt. of flour. The second alters the equation over time in that the price of flour does not vary exactly with the price of wheat.

$$C_f = L(1.73 - .000223P_f + .00054\frac{D}{L} - .0121T - .00475M)$$

in which:

C_f—Consumption of flour (million cwt.)
L —Population
P_f—Price of flour
$\frac{D}{L}$, T, M are as in the previous equation

The effects and relative weights are the same as in the previous equation. The principal difference is in the use of regional population in place of capacity for flour production. The data needed for this stage of the equilibrium solution are arranged in Table III.

The transfer rates for flour were taken directly from the Interstate Commerce Commission, and modified where Army Corps of Engineers data indicated

TABLE III

DATA FOR THE FLOUR PROBLEM*

	Flour production	
Northeast	66.5[a]	64.9[b]
Midwest	86.7	88.8
South	5.8	4.6
Southwest	20.2	20.1
West	28.0	29.1
United States	207.0	207.0

*Other data used in the flour problem and data sources are given in Table I.
[a] Data in this column are estimates from solution of the wheat problem.
[b] Data in this column are estimates from the Census.

TABLE IV

INTERREGIONAL FLOUR TRANSPORTATION COSTS*
(cents per 100 lbs.)

	Northeast	*Midwest*	*South*	*Southwest*
Midwest	57	..	...	..
South	36	92	...	..
Southwest	92	43	43	..
West	114	57	114	75

*Costs are for distances between the centers of regions.
Sources: See Table II.

substantial shipments by water over the Mississippi River System. Consequently, the rates between regions Midwest and Southwest, Midwest and South, and Southwest and South were lowered (Table IV).

TRADE PROJECTIONS

A necessary condition for the equilibrium of supply and demand is that total disappearance will equal the total supply available for use. This cannot occur unless prices are in an equilibrium, dependent upon regional supply and demand conditions and the structure of transport costs. If the price is too low in a deficit region, this will leave another region with a surplus. The surplus may be consumed, but at an economic loss to the system, due to the failure of competition to complete the equilibrium. The problem of trade projection is to work out the equilibrium of trade and prices.

TABLE V

TRADE SOLUTION FOR WHEAT, 1954
(millions of bushels)

	*Equilibrium price**	*Wheat supply*	*Wheat consumption*	*Net trade*
Northeast	260	78	154	−76
Midwest	230	245	201	44
South	285	9	13	−4
Southwest	270	36	47	−11
West	180	112	65	47
United States	242	480	480	±91

*Cents per bu.

The Wheat Solution

Transport rates for wheat indicate that the Northeast has a competitive advantage over the Southwest for the market of the South. This is evident from the rates under the assumptions of the model. If the price in the Midwest is $2.00, the price in the Northeast becomes $2.30 and in the South, $2.55, but via the Southwest the price would be $2.80 and non-competitive.

Given this assumed pattern of trade, sets of prices were substituted into the basic demand equation until total disappearance amounted to 480 million bushels of wheat and the United States average price was $2.42. The result of these substitutions was the map presented earlier (Fig. 2). The solution is also given in Table V.

The Flour Solution

The structure of transport rates and supply conditions by regions indicates a structure of trade similar to that for wheat, with the exception that the Southwest has the advantage over the Northeast for the market of the South. Sets of prices were substituted into the demand equation until total disappearance amounted to 207 million cwt. of flour, and the average United States price was $7.09. The final equilibrium trade solution was then determined (Table VI and Fig. 2).

The pattern of trade for flour differs from that of wheat principally in that the Southwest rather than the Northeast satisfies the deficit of the South. This is probably due to the fact that the Southwest was more strongly deficit of wheat than the South, while in the case of flour, the Southwest has a surplus. However, the Southwest itself does not have a sufficient surplus to satisfy the needs of the South. Consequently, the movement from the

Midwest to the Southwest probably includes both wheat to replace that which the Southwest shipped to the South from closer points, and direct shipments to the South via the Mississippi River system (a transshipment).

TABLE VI

TRADE SOLUTION FOR FLOUR

1954

(million cwt.)

	*Equilibrium price**	*Flour production*	*Flour consumption*	*Net trade*
Northeast	724	66.5	98.6	-32.1
Midwest	667	86.7	22.3	64.4
South	753	5.8	41.4	-35.6
Southwest	700	20.2	17.3	2.9
West	610	28.6	27.4	.6
United States	709	207.0	207.0	±67.5

*Cents per 100 lbs.

ACCURACY

The figures determined in the trade equilibrium solution pose a major problem: what is their accuracy in relation to actual patterns? Unfortunately, it is not possible to compare results with the actual pattern. Total movements of wheat and flour are not known because railway shipments, for which there are some data, account for less than one-half total shipments. Statistics on flour production are available for a limited number of states only, and no figures are available for flour consumption. Nevertheless, the results obtained seem to be quite close to what actual data is available, with prices exhibiting the greatest variability.

Paths of movement are known to exist which were not identified by the projections. This illustrates one of the major weaknesses of the technique, namely, the assumption of large mutually distinct regions, conveniently centered at a point. The extra- and intraregional movements, which were not detected, were obscured by the grossness of the regions chosen.

Deficiencies of data necessitated the use of some estimation in the following cases: wheat supply by regions for flour, flour capacity by regions, flour production by regions, and average transport costs between regions. These deficiencies apply equally, of course, to estimation by any other technique. In any case, spatial price equilibrium has three clear advantages which tend to offset its lack of accuracy and laborious solution: (1) the structure of freight rates is utilized, measuring the effect of differing distances between regions, and providing a definite prediction of the paths of movement; (2) differing demand and supply conditions are recognized, permitting the prediction of consumption rather than assuming it; and (3) a specific representation or explanatory model of the process of trade is provided.

EXTENSION OF THE MODEL TO ALTERNATIVE CONDITIONS

Once formulated, the model may easily be used to test the effects of changes in internal regional conditions or external transportation connections. In this paper, two alternate trade solutions are given. One shows the effect of a supply change in the Midwest, say resulting from a drought. The other solution shows the effect of changes in the distribution of population among regions.

TABLE VII

POSTULATED WHEAT SUPPLIES

Region	*Supply in million of bushels*	
	1954	*Postulated*
Northeast	78	76
Midwest	248	215
South	9	10
Southwest	36	50
West	112	120
United States	480	470

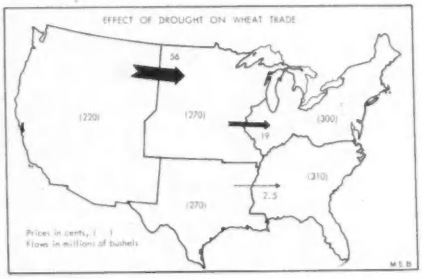

FIG. 3.

Effect of Drought

For this alternate solution, changes approximating drought conditions were postulated in regional wheat supplies (Table VII).

The effect of the decreased supply in the Midwest and the increased supply in the West and the Southwest is interesting and can be seen in the equilibrium solution (Fig. 3). The pattern of wheat shipment changes radically. The Midwest and the Northeast cease to make up the deficits of the Southwest and the South respectively, and the latter form an equilibrium system of their own. There is no change in the pattern of flour shipment. All prices are higher as a result of the decreased supply.

Population Changes

In accordance with trends, the national population was rearranged, with relative growth in the Southwest and the West, and a relative decline in the Northeast, Midwest, and South. For convenience, the total was unchanged (Table VIII).

TABLE VIII

POSTULATED POPULATION CHANGES

Region	Population in millions	
	1954	Postulated
Northeast	74.5	70
Midwest	18.3	15
South	34.2	30
Southwest	15.2	21
West	22.5	30
United States	166	166

These changes affect only the equilibrium solution for flour. Since no changes in flour capacity were assumed, an important change in pattern results (Fig. 4). All regions are deficit except the Midwest, which ships directly to the West, the Northeast, and the Southwest, and indirectly to the South through the Southwest. The price in the West becomes a great deal higher, as a result of its importing position. This test is not unlike the possible situation during a subsequent decade. Regional population shifts are far greater than changes in flour capacity, which even today is 20 per cent greater than production, as a result of the historical decline in per capita flour consumption.

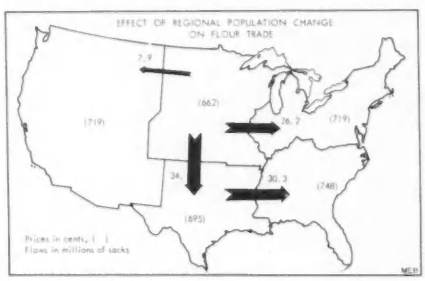

FIG. 4.

CONCLUSION

The above examples illustrate the usefulness of this analytic approach to the pattern of trade. It is a means to the understanding of a whole array of geographic problems. It is particularly useful and significant because it shows that the trade patterns resulting from geographic location and differentiation are not random or haphazard, but are at least somewhat regular and predictable. Finally, it provides a

more adequate explanation of certain problems of trade than was formerly available.

TECHNICAL NOTE

Solution of the spatial equilibrium problem requires finding the price in each region, net regional consumption, and the magnitude and direction of the imports or exports within each region.[9] This is a generalization of a problem known as the transportation problem.

The Transportation Problem

In the transportation problem regional excesses, deficits, and interregional transportation costs are given. The problem is to find that set of interregional flows which will match excesses and deficits with the least total transportation cost. Let a_i be the excess of the i^{th} member of the n excess regions; b_j be the deficit of the j^{th} member of the m deficit regions; and transportation costs between the i^{th} and the j^{th} regions be t_{ij}. Find that set of interregional flows, x_{ij}, which minimizes total transportation costs, C.

$$(1)\quad \text{Minimize: } \sum_{i=1}^{n}\sum_{j=1}^{m} x_{ij}t_{ij} = C$$

$$(2)\quad \text{Subject to: } \sum_{j} x_{ij} = a_i$$

$$(3)\quad \sum_{i} x_{ij} = b_j$$

$$(4)\quad \sum_{j} b_j = \sum_{i} a_i$$

$$(5)\quad x_{ij} \geqslant 0$$

This may be treated as a linear programming problem. A fundamental theorem of linear programming identifies a dual problem which accompanies the primal problem (above). In this case, a vector of u_j's and v_i's is found which solves the following problem.

$$(6)\quad \text{Maximize: } \sum_{j=1}^{m} u_j b_j - \sum_{i=1}^{n} v_i a_i = C$$

Subject to:

$$(7)\quad u_j - v_i \leqslant t_{ij}$$

$$(8)\quad u_j \geqslant 0;\ v_i \geqslant 0.$$

C in (6) is equal to C in (1). Other results from linear programming indicate that if $x_{ij} > 0$ in the solution of the first problem, equalities hold in the related equation in (7). The u_j and v_i are commodity prices in the exporting and importing regions.

Solution of the General Problem

In the transportation problem, total excesses and deficits of regions are known. The problem is solved by systematically finding interregional flows, using the tableau of interregional transport costs. In the general spatial equilibrium problem, a set of excesses and deficits must be generated by assuming a price in one region, determining the prices in other regions, and solving the demand equations for regional excesses and deficits.

At this juncture, the dual transportation problem provides a guide for finding equilibrium prices. For example, the first set of assumed prices will undoubtedly result in exports and imports that do not satisfy the restrictions of the transportation problem (2, 3, and 4). Ordinarily, this would be corrected by a tedious altering of the level of prices, recomputing excesses, etc. However, this may be in vain, and there may be no solution, so the structure of prices must be changed. This can be done by determining feasible price structures from the dual (7).

With a feasible structure of prices, exports and imports can be computed. Generally, only a few interregional

[9] For an expository discussion of this problem and an example solution see G. G. Judge and T. D. Wallace: "Estimation of Spatial Price Equilibrium Models," *Journ. of Farm Econ.*, Vol. 40, 1958, pp. 801–820.

movements are possible, and those links with the greatest differences between u_j and v_i prices, taking into account transport costs, should always take priority.

The first solution attempted will generally violate restrictions (4). The prices in equations (7) should then be raised or lowered. One might gradually alter price levels, recalculating each time, until total exports equal total imports. However, conditions (4) may provide a short cut. If total supply is known, the average equilibrium price can be found from the demand equations. The difference between this price and the average price given by the non-optimal solution is the exact correction on price levels needed to equate exports and imports. Consequently, only two iterations are needed in this problem, unless the change in price level is sufficient to permit additional flows or forbid others.

A DECADE OF POST-WAR FORESTRY IN GREAT BRITAIN*

J. T. Coppock

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IN May, 1956, Queen Elizabeth unveiled a memorial at Eggesford Forest, Devon, to mark the planting of the millionth acre of forest by the Forestry Commission, the bulk of it since 1945. Although small by world standards this acreage represents a quarter of the total area under woods in Britain and nearly half the area under high forest. The significance of the achievement is greater than the acreage figures suggest, for the new plantations generally differ in composition from the existing woodlands, while many have been established in areas in which there were few trees, notably the open moors of Highland Britain. The Forestry Commission have thus transformed the landscape over large tracts of Great Britain, and their proposals envisage planting on an even larger scale. Much less has been done, however, than was hoped, and a recent modification of the Forestry Commission's program of planting by the Government offers an appropriate opportunity to review the Commission's achievements and to bring up to date the picture presented by the 1947 Census of Woodland.

*Figures given in this article are derived from the Annual Reports of the Forestry Commissioners, the Report on Post War Forest Policy, and the Census of Woodlands, 1947–1949. All dates referring to plantings and targets, both in the text and illustrations, are in forest years; these run from October 1 to September 30, so that 1947 means the year ending September 30, 1947.

The Origins of Modern Policy[1]

Although most of Britain was once forested, woodland now covers only some 7 per cent of the country, and 85 per cent of her timber requirements are imported. In 1914, 97 per cent of the area under woods was privately owned (the remainder being Crown woodlands) and broadleaved trees predominated. The blockade during the first World War made it necessary to fell some 450,000 acres of woodland, the bulk under conifers, and the serious shortage of timber led, through the recommendations of the Acland Committee, to the establishment of a Forestry Commission, charged with the task of creating State forests. The Acland Committee had proposed that a total of some 4,750,000 acres of productive forest should be created by 1999 (of which 290,000 acres would be in Ireland), 1,770,000 acres by afforestation, that is, the planting of land which has not carried woodland in recent times, and the remainder by the rehabilitation of existing woodland.

By September, 1939, 369,000 acres had been planted by the Forestry Commission, rather more than two-thirds of which were afforested; this acreage was only 75 per cent of that proposed

[1] See Post War Forest Policy, Cmd. 6447, H.M.S.O., London, 1943, pp. 10–19, and 30th Annual Report of the Forestry Commissioners, H.M.S.O., London, 1950, pp. 20–36.

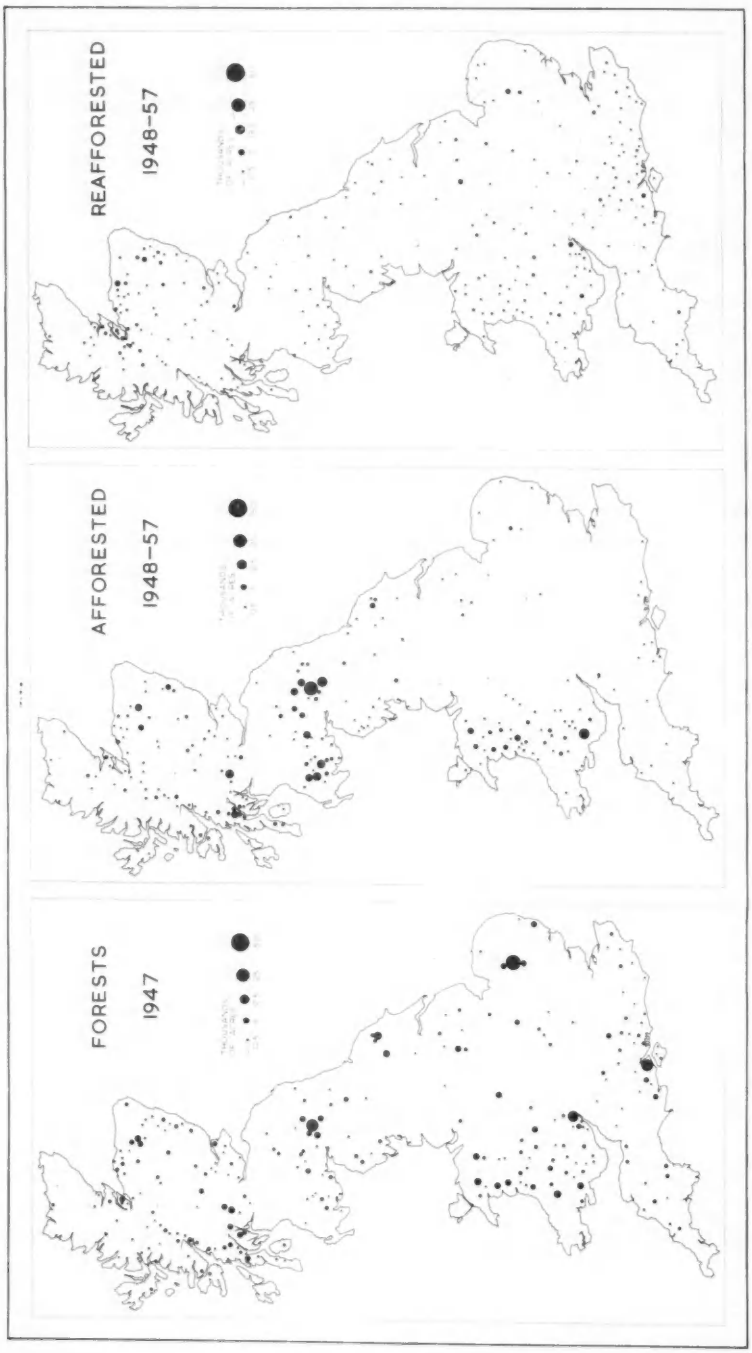

FIG. 1. Total plantings in Great Britain for the years 1948 to 1957. (Source: Annual Reports of the Forestry Commissioners.) The minimum size of circle shown represents 500 acres.

for afforestation alone by the Acland Committee. During the same period private owners, who planted a further 126,000 acres, achieved only 66 per cent of their target. Indeed, total planting had barely exceeded wartime losses when the second World War made fresh demands on home supplies of timber. Forestry Commission plantations were generally too young to be felled, and less than 30,000 acres were clear-felled, compared with 344,000 acres of private woodlands, mainly in Scotland. A further 139,000 acres under private ownership, mainly in England, were devastated, that is, cleared of all usable timber, leaving only poor quality trees, compared with 12,000 acres of State woods.

A reappraisal of forestry policy by the Forestry Commission led in 1943 to a Report on Post War Forest Policy in which an area of 5 million acres of productive forest was proposed, of which 3 million acres were to come from the afforestation of bare land and the remainder from that portion of the existing woodland which was suitable for economic management. The operation was to take 50 years, and the bulk of afforestation would have to take place on the rough grazings of the uplands, of which 4.2 million acres were thought to be suitable for planting. While these proposals have never been accepted in their entirety by the Government, they were sympathetically considered, and authority was given to proceed with the first five years of the plan. The forest year ending September 30, 1947, was adopted as the first year of the program.

Developments Since 1947

This year also saw the start of the postwar census of woodland, which provides a very detailed picture of the extent and nature of the British woodlands. Although private woodland is analyzed in detail in the census, it will be necessary to confine this discussion of subsequent developments largely to State forestry, since information about private plantings is incomplete and available only in broad outline. This serious lack of data is partly offset by the fact that the contribution of private forestry to new planting has been considerably smaller than that of State forestry, despite the fact that private woodlands are much more extensive; moreover, private forestry has been concerned with the replanting of existing woodland rather than with direct afforestation. Since the 1947 Census, some 184,000 acres (equivalent to 7 per cent of the total acreage of private woodland) have been planted by private landowners. Of this over 60 per cent has been coniferous and under 10 per cent broadleaved plantations, the balance consisting of mixed woods. But a similar area, mainly of broadleaved trees, has been clear-felled, while some 250,000 acres of private woodlands have been acquired by the Forestry Commission, largely for replanting. The private woodlands are thus less extensive than they were in 1947, and the proportion of coniferous trees is higher.

For the State forests, data on planting are published by individual forests, so that much closer analysis is possible, though information on the species planted is available only by conservancies.[2] The total plantings for the years 1948–1957 (roughly since the last census of woodland) have been plotted in Figures 1 and 2. As far as possible dots have been placed on the location of the forests as given in the Annual Reports of the Forestry Commission; but the fragmented character of the woodland and the small scale of afforestation in Lowland Britain have made it

[2] Administrative divisions of the Forestry Commission.

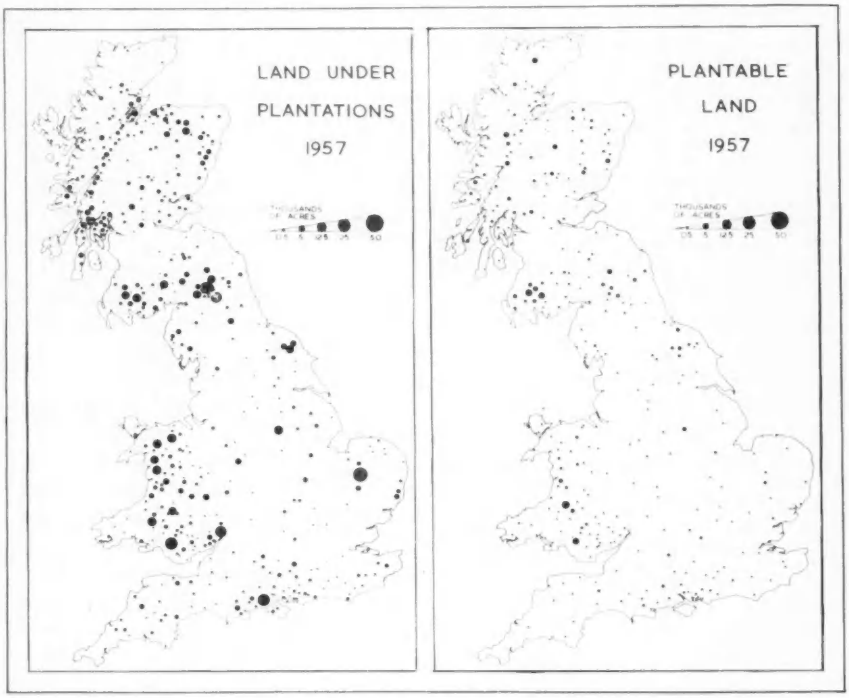

FIG. 2. The situation in 1957. (Source: Annual Reports of the Forestry Commissioners.)

necessary to generalize here, since much of the planting in individual forests is too small to be shown.

The first section of Figure 1 shows the extent of the Forestry Commission plantations in 1947 and their location mainly on the fringes of the uplands. In northern Scotland a ring of plantations surrounded the Grampians, within which there were only a few forests in the glens which dissect them; in Wales the peripheral distribution of the plantations was less marked owing to the lower elevation and fragmented character of the uplands. A cluster of forests surrounded the large Kielder Forest in the Border country, while other large blocks of plantations lay in East Anglia (Thetford Chase), Hampshire (the New Forest), and Gloucestershire (the Forest of Dean), the last two being former Crown woods. Smaller plantations existed in Sherwood Forest, the North York Moors, Cannock Chase, and at the western end of the Weald, but State woods were less common in Lowland Britain where most woodland is privately owned. Some of the uplands, too, had few plantations, notably in northern England, northwest Scotland, and, to a lesser extent, the southwest peninsula. The reasons for this uneven distribution of Forestry Commission plantations in the uplands are partly the lack of available land and partly the environment. Much land in the Pennines, the Lake District, and Devon and Cornwall is Common Land, which, under present law, cannot be acquired by the Forestry Commission; in the Lake District planting is further limited by an agreement between the Forestry

Commission and the Council for the Preservation of Rural England to restrict planting in the central 300 square miles in order to preserve the character of the area.[3] A contributory factor in the southern Pennines is the nearness of the industrial regions of Lancashire and Yorkshire, since most conifers are very sensitive to industrial fumes. In the extreme southwest and northwest of Great Britain exposure and strong winds make commercial tree growth impossible; much of the higher uplands is similarly unsuited to the production of salable timber, while the highest parts lie above the climatic tree line.

Most of these plantations consist of trees which have been planted since 1919, though the former Crown woods, transferred to the Commission in 1923, and parcels of standing woods acquired by the Commission contain older trees. Except in Lowland Britain, the trees in these plantations are overwhelmingly conifers; at the 1947 Census, conifers accounted for 97 per cent of the woodland planted by the Commission, the chief species being Sitka Spruce (30 per cent), Scots Pine (21 per cent), Norway Spruce (17 per cent), Corsican Pine (7 per cent), European Larch (6 per cent), Japanese Larch (6 per cent), and Douglas Fir (5 per cent). State forests thus contrasted markedly with private woodlands, where conifers accounted for only 38 per cent of all high forest and oak was the chief species (31 per cent).[4]

Since 1945, the Forestry Commission have planted 615,900 acres, 579,100 of them since 1947; of this latter acreage 368,700 acres have been afforested, the remainder being the reafforestation of former woodland which had recently been cleared of scrub or clear-felled. The afforested areas (Fig. 1) show two main concentrations, one in the southern and southwestern margins of the Southern Uplands of Scotland, the other on the western and southern margins of the Welsh uplands. Afforestation has also taken place around the Grampians, especially in southern Argyll; but in Lowland Britain little land not recently under woods has been planted. Reafforestation has been much more uniformly distributed, though it is relatively important in eastern Scotland, Wales, and southern England (Fig. 1). This fact can be more readily appreciated from the summary map (Fig. 3), in which plantings by conservancies are shown in relation to the planted area in 1947. New planting has been large compared with the extent of existing forests in Highland Britain, and small in Lowland Britain where most planting has been replanting of existing woods.

The areas shown as afforested and reafforested in Figure 1 are not a true measure of the increase in the area under plantations, since some forests have been sold, while in others clear-felling, fire, and windblow have reduced the planted area. But the acreage so lost has been relatively small; it was private rather than State forests which suffered severely from windblow in the gales of 1952 and 1953, the annual loss from fire has averaged less than a thousand acres, and the area clear-felled has not exceeded 8000 acres per annum, mainly of acquired woodland. The net effects of the changes can be seen by comparing the first map of Figure 1 with the first map of Figure 2. The dominance of the margins of the three upland areas of Wales, the Southern Uplands-Border country, and the Grampians is now overwhelming; the high uplands, the areas of Common Land, the coastal areas, and the

[3] Report of the Royal Commission on Common Land 1955–1958, Cmd. 462, H.M.S.O., London, 1958, Appendix IV. Also 6th Report of the National Parks Commission, H.M.S.O., London, 1955, p. 25.

[4] Census of Woodlands 1947–1949, Census Reports No. 1, H.M.S.O., London, 1952, p. 124.

better agricultural lands of Lowland Britain still have little woodland.

These maps portray total changes for this decade; comparison of annual plantings, however, shows that there has been a shift of emphasis over the decade; in the first half, most of the new planting occurred in areas established in 1947, and in the second half in the areas in which there were relatively few plantations in 1947. The map of reserves of plantable land (Fig. 2) shows that this trend is likely to continue, particularly in the Southern Uplands. Southern Scotland, which accounted for 11½ per cent of all plantings in 1948 and 15½ per cent in 1957, and Northern Scotland, with 9½ per cent and 12½ per cent respectively, are likely to become even more important.

The species planted have not been the same throughout Great Britain, although, as Figure 3 shows, they have been overwhelmingly coniferous, except in eastern, southeastern, and southwestern England, where most planting has been replanting, in which broadleaved species have played a larger part (Fig. 4). As might be expected, the more extreme the conditions the fewer the species planted. In north and east Scotland the Scots Pine predominates, followed by Sitka Spruce and Japanese Larch. In the moister conditions of west and southwest Scotland, northern England, and Wales, the Sitka Spruce has been the principal species planted, followed by Norway Spruce, Japanese Larch, and Scots Pine (though not necessarily in that order). In Lowland Britain, beech is the chief species and Corsican Pine the principal conifer. The relative importance of the different species is largely an indication of the kind of land planted. Sitka Spruce is particularly suited to the peaty soils of the wet grass moors, while Scots Pine is more suitable for planting on the drier heather moors

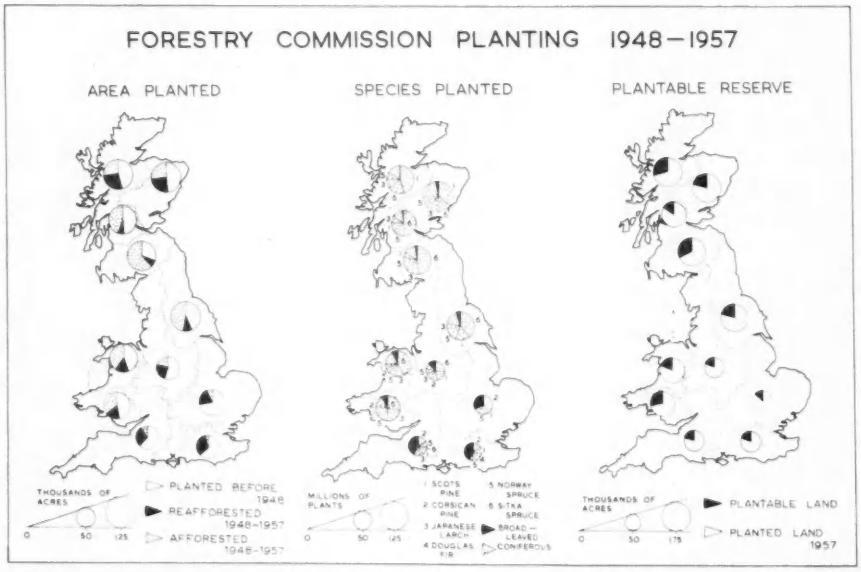

FIG. 3. Summary map of plantings by conservancies. Boundaries shown are those of conservancies. The small conservancies of the New Forest and Forest of Dean have been included in the southwest and southeast conservancies respectively. (Source: Annual Reports of the Forestry Commissioners.)

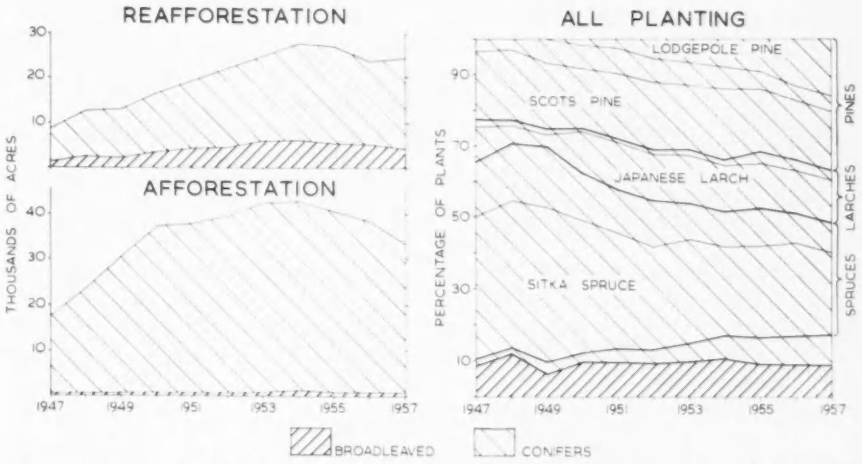

Fig. 4. Trends in species planted. (Source; Annual Reports of the Forestry Commissioners.)

in the eastern part of the country. The emphasis on conifers is itself a reflection of the poor quality of most of the land planted; hardwoods require the better soils and climate of the lowlands.

These figures for the composition of all plantings similarly conceal both shifts in emphasis throughout the decade and contrary trends in the different regions. As Figure 4 shows, the spruces, and particularly the Sitka Spruce, which has been the characteristic species planted by the Forestry Commission, have declined in favor of other species, notably the Lodgepole Pine and other minor conifers. This change is partly an indication of the less suitable ground now available for afforestation, on which the hardy Lodgepole Pine is often used as a pioneer species, or as nurse crop for spruce. Scots Pine has also maintained its position partly by its use as a nurse crop.

Figure 5 shows changes in the composition of planting in four representative conservancies. In north Scotland and northeast England the Scots Pine has maintained or improved its relative position, but in southeast England it has been replaced by Corsican Pine, Norway Spruce, and Douglas Fir; the faster growing and less sensitive Corsican Pine has been planted both in its own right and as a pioneer for hardwoods, particularly on chalk. In the other conservancies both Norway and Sitka Spruce have declined in relative importance, chiefly at the expense of other coniferous species (probably mainly Lodgepole Pine).

Failure to Achieve Targets

This decade of planting has considerably altered and modified the extent and composition of woodland in Britain; in particular, the species planted have not been those which characterize the existing woodland, and the areas planted have not, in the main, been those already heavily wooded. The effects would have been even more marked if the Forestry Commission's proposed acreage of new planting had been achieved. In fact, in the first decade of the program only 61 per cent of the target acreage has been planted; as Figure 6 shows, the annual plantings have been well below those suggested

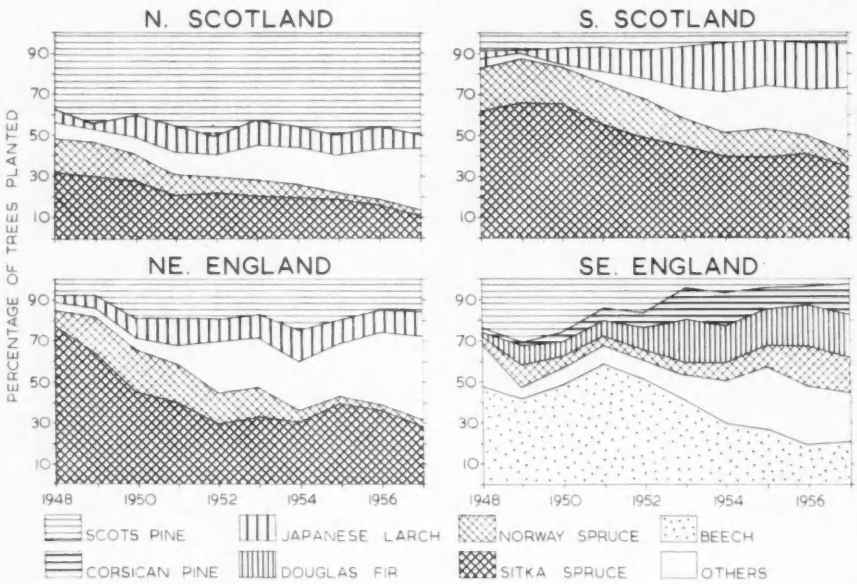

FIG. 5. Changes in composition of plantings in four conservancies. Only major species are shown. (Source: Annual Reports of the Forestry Commissioners.)

in Post War Forest Policy, and have been falling since 1954. This failure to reach the target acreage has been more marked in the replanting of existing woodland (49 per cent); but afforestation has been only 70 per cent of that proposed. Private planting, on the other hand, has more nearly attained its smaller target acreage, and has continued to increase.

The chief reason for this failure to achieve the proposed acreage of State planting has been the failure to acquire plantable land in sufficient quantities.[5] Figure 6 shows how the acreage acquired has fallen far short of that proposed, being only 26 per cent of the target for the first decade. This failure was most marked in the first few years when it was proposed to build up a reserve of plantable land; in Post War Forest Policy a margin of ten times the annual planting was held to be necessary, and, although experience has shown that a smaller reserve is practicable,[6] acquisitions have been even less than plantings for most of this period. Reserves have been falling, and the rate of planting must decline even further.

The causes of this failure to acquire sufficient plantable land are numerous. Acquisition of land for reafforestation has probably been hindered by uncertainty on the part of private landowners about the future of private forestry; such uncertainty has also produced a slow initial response to the dedication scheme, under which private woodlands are managed on an approved system. Acquisitions of bare land for afforestation have been handicapped chiefly by the fact that such land is already used for other purposes, particularly agricul-

[5] 37th Annual Report of the Forestry Commissioners, H.M.S.O., London, 1957, p. 7.

[6] 32nd Annual Report of the Forestry Commissioners, H.M.S.O., London, 1952, p. 11.

ture. Both a growing awareness of the scale on which agricultural land is being lost to urban uses and the power of the agricultural lobby make it difficult for the Forestry Commission to acquire and plant agricultural land. The 1945 Forestry Act made the Commission subject to directives from the Minister of Agriculture and the Secretary of State (who is responsible for agricultural matters in Scotland), and approval has to be obtained from the agricultural departments before agricultural land is taken for forestry.[7] The need for prolonged consultation often handicaps the Commission in negotiating purchases, and the prohibition of the use of good agricultural land means that only the poorer land, much of it unplantable, is potentially available to the Commission. The statutory security of tenure enjoyed by tenant farmers is also an obstacle to the purchase of agricultural land.

The relative prosperity of agriculture is also thought by the Commission to be an important reason for the failure to acquire sufficient land; but the way in which it operates is not clear. While the average price paid in 1957 is only 72/6 per acre, the failure to offer a sufficiently high price for land is not, in the Commission's view, a factor. They contend that they have paid the market price, and believe that higher prices would not greatly affect the amount of land being offered.[8] Probably agricultural prosperity acts indirectly by allowing landowners to indulge the prejudice and even hostility which many members of the agricultural community feel towards the Commission.

There are a number of other handicaps. Some potentially plantable land is used not only by agriculture but for other purposes, notably grouse shooting, military training, and water gathering. Other suitable land lies in National Parks or in areas of outstanding natural beauty where planting must be restricted both in scale and in the species used; thus a recent proposal to acquire 1200 acres of land for afforestation in the Exmoor National Park was opposed by the National Parks Commission.[9] Nevertheless, the fact that most plantable land is agricultural land is the greatest obstacle. Recent proposals to

[7] Royal Commission on Common Land, Minutes of Evidence, 6, Forestry Commission, H.M.S.O., London, 1956, p. 218.

[8] *Ibid.*, p. 231.

[9] 9th Annual Report of the National Parks Commission, H.M.S.O., London, 1958, p. 29.

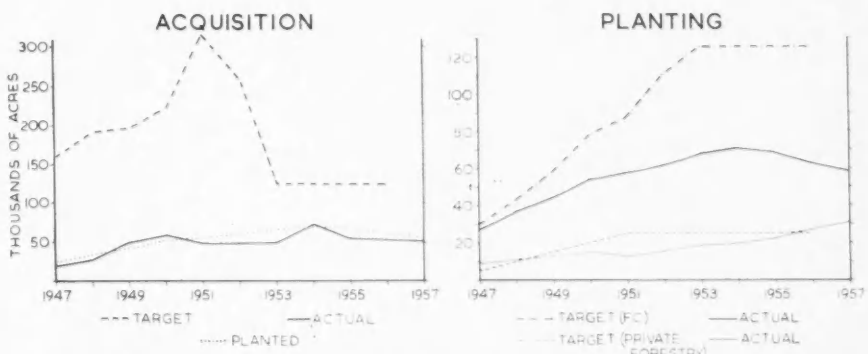

Fig. 6. Annual plantings as compared with suggested plantings. (Source: Post War Forest Policy and Annual Reports of the Forestry Commission.)

aid small farms, which are typical of the hill margins where the Commission wish to acquire land, make it likely that such land will become even more difficult to acquire.[10] And, while the Commission have powers of compulsory purchase, these have been invoked only once in the past 40 years, and the present climate of opinion makes it unlikely that they could be used to acquire any considerable quantity of land.

FUTURE PLANTING

It is clearly difficult to predict the scale and location of future planting (apart from that on existing reserves of plantable land), since both depend on Government policy. The rate of planting for the next decade announced by the Government in July, 1958, is approximately only one-third of that originally proposed by the Forestry Commission; and, although the acreage planted by private owners has been increasing, it is clear that the target of 5 million acres of productive woodland, which the Commission think is still both realistic and desirable, cannot possibly be achieved by 1996.[11]

While the rate of planting has thus been reduced, the balance between afforestation and reafforestation has been considerably altered by the discovery in the 1947 census that the area of existing woodland suitable for economic management was nearly a million acres more than had been estimated in Post War Forest Policy. The area required for afforestation was, therefore, little more than 2 million acres, of which one-sixth has since been planted. Presumably there has been a corresponding increase in the area to be replanted; since 1947, approximately one-seventh of the existing woods have been reafforested. Future replanting will, of course, take place largely in the east and south.

Though the area still required for afforestation is smaller than had been thought, it is nevertheless large. In view of the continued loss of agricultural land to urban development, it is highly unlikely that any substantial quantity of land for afforestation will ever be found in the lowlands. Indeed, attention is now being directed towards the possibility of reclaiming derelict woodland for agriculture. In the uplands, the 4.2 million acres which were thought plantable in 1943 have been reduced by less than 400,000 acres by subsequent afforestation; precise figures cannot be given because the location of the plantable land is not known. Land already in the Commission's hands awaiting planting may account for a further 300,000 acres, and the original estimate may have included 800,000 acres of Common Land in England and Wales (equivalent to nearly half the remaining plantable land in both countries) which, though plantable, cannot be acquired.[12] Thus a balance of at least two and three-quarter million acres of plantable land remain for future afforestation. This figure has certainly been increased by technical developments in forestry, just as the plantable area was increased by several hundred thousand acres between the wars.[13] There is clearly sufficient plantable land in the uplands if it can only be made available. Amendments to the law relating to Common Land proposed by the recent Royal Commission could make available up to 400,000

[10] Assistance for Small Farmers, Cmd. 553, H.M.S.O., London, 1958.

[11] Parliamentary Debates, 592, H.M.S.O., London, 1958, Column 686. Minutes of Evidence, *loc. cit.*, p. 229.

[12] Royal Commission on Common Land, *op. cit.*, p. 8.

[13] Post War Forest Policy, *op. cit.*, p. 36. Royal Commission on Common Land, Evidence of Forestry Commission, p. 227.

acres which the Forestry Commission think could be afforested without prejudice to the needs of agriculture and recreation.[14] More of the half million acres of gathering grounds could also be afforested; in 1956 less than half were used for agriculture and only 17,000 acres were under trees, and, although informed opinion is not agreed about the effects of afforestation on water supply, more could certainly be planted.[15] Bracken-infested land, much of it on steep slopes unsuited to agriculture, is an obvious target for afforestation; there are more than 400,000 acres of such land in Scotland and an unknown but large acreage in England and Wales.[16] But much of it is in small parcels which are often uneconomic to manage. Planting of such small areas in the interests of agriculture may, however, be the only way in which sufficient land will be forthcoming for future planting. The Zuckerman Committee, which recently considered this problem, thought that only by winning the co-operation of agriculture would acquisition of the necessary acreage be possible.[17]

Location of suitable available land for afforestation is not likely to be the only factor deciding the location of future planting. Special attention is to be paid to areas in which an expansion of forestry would provide needed diversification of employment and improved social benefits; the special program of planting for the crofting counties in Scotland already provides an example of the way in which social considerations can affect the Commission's work.[18] Considerations of landscape beauty and of public access are also likely to be much more important than in the past. Much of Highland Britain will ultimately be designated as National Parks or areas of outstanding natural beauty, in which the National Parks Commission would prefer to see open country left in its existing state.[19]

Conclusion

Less has been achieved in this postwar decade than had been hoped, but the result is nevertheless impressive. A much larger acreage has been planted than in the interwar years, and its effects have been accentuated by the fact that much has been concentrated in a limited part of the uplands. Future planting or known reserves will accentuate this tendency (Fig. 3). Although it will be impossible to give precise figures until a further census of woodland is attempted, many of the counties of Wales, the Border country, and the Southwest Highlands now join those of northeast Scotland and southeast England as comparatively heavily wooded areas with over 10 per cent of their surface under wood. Although there remain large tracts with little woodland on the clay lowlands and in the extreme west and north, postwar afforestation has produced a more uniform distribution of woodland. It is true that postwar planting is equivalent to only some 25 per cent of the total woodland area in 1947; but much of this woodland was woodland in name only, consisting of scrub, felled, and devastated woodland, and if the comparison is confined to productive woodland the area has been roughly doubled. Much of the wartime

[14] *Ibid.*, p. 219.
[15] Forestry Agriculture and Marginal Land, H.M.S.O., London, 1957, p. 20.
[16] The Size of Scotland's Bracken Problem, G. F. Hendry, Scottish Agricultural Economics, IX, 1958, pp. 25–28.
[17] Forestry Agriculture and Marginal Land, *op. cit.*, p. 38.
[18] Parliamentary Debates, *loc. cit.* 37th Report, *op. cit.*, p. 9.
[19] 9th Report of National Parks Commission, *op. cit.*, p. 13.

felling has been made good by private planting and by replanting acquired woodland, and extensive tracts of new forests have been created. Moreover, it is no longer possible to say, as it was in 1947, that over large tracts of the British scene conifers are less common than at any time in the recent past.[20] New plantations of exotic conifers are now the most striking feature over large tracts of the British uplands.

[20] Census of Woodland, *op. cit.*, p. 160.

THE PATTERN AND DISTRIBUTION OF MANUFACTURING IN THE CHICAGO AREA

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THE Chicago Standard Metropolitan Area (Fig. 1) is the second-ranking manufacturing area in the United States. Its national prominence is best indicated by the fact that in 1954 it contributed more than 10½ per cent of the nation's "value added by manufacture." Some recent studies, as well as data from the *Census of Manufactures*, reveal several interesting relationships and trends within this important industrial area with regard to manufacturing activities in the central city as compared with the remainder of the metropolitan area.

City of Chicago Compared with Remainder of Standard Metropolitan Area

Although the City of Chicago comprises less than 6 per cent of the Chicago Standard Metropolitan Area it contains two-thirds of the population and approximately the same percentage, or more, of the major economic activities associated with the American metropolis.

Table I shows that the suburbanization movement between 1940 and 1950 resulted in a population loss of only 4½ per cent for the central city and that almost 66 per cent of the population still lived in the City of Chicago in 1950. While there has been additional suburbanization since 1950, it is significant that the primary labor market of the metropolitan area is in the City of Chicago and that this continues as a major factor attracting additional manufacturing establishments to the central city.

The high degree of centralization of manufacturing in the City of Chicago is also revealed in Table I.[1] Manufacturing expanded very rapidly in the Chicago Standard Metropolitan Area between 1939 and 1947 in both suburban and central areas. Industrial activity was actually slightly more concentrated inside the central city in 1947 than in 1939. This was not true for any of the other economic functions. Neither was it true for population, which had suburbanized most rapidly. Furthermore, the manufacturing labor force, as represented by production workers, drifted to the suburbs more slowly than the general population prior to 1948.

The strongest drift of industry to the suburbs occurred after 1947, according to 1954 Census data, with the greatest change being in number of establishments (see Table I). Production workers continued to decentralize less rapidly than did establishments or production, as measured by value added by manufacture.

[1] For a comprehensive study of suburbanization of manufacturing in all of the Metropolitan areas in the United States see Evelyn M. Kitagawa and Donald J. Bogue: "Suburbanization of Manufacturing Activity Within Standard Metropolitan Areas," *Studies in Population Distribution*, No. 9, 1955 (Scripps Foundation, Miami University, Oxford, Ohio or Population Research and Training Center, University of Chicago, Chicago, Illinois).

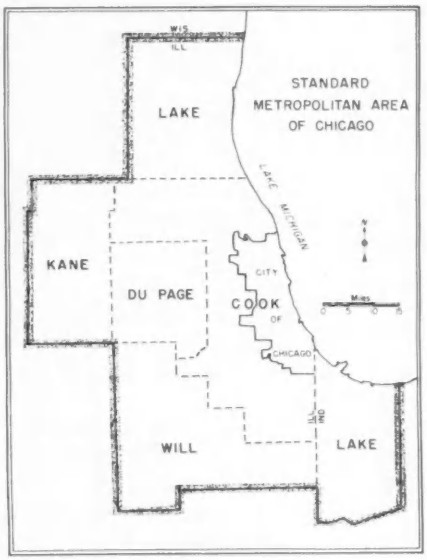

FIG. 1.

A more detailed analysis of the industrial suburbanization trend is afforded by outlining zones for the Chicago Standard Metropolitan Area and by using information obtained from the records of the Territorial Information Department of the Commonwealth Edison Company of Chicago.

RECENT INDUSTRIAL MOVEMENTS BASED ON A ZONAL ARRANGEMENT FOR THE CHICAGO STANDARD METROPOLITAN AREA

A number of persons and organizations have ascribed zones to the structure of the Chicago Standard Metropolitan Area for a variety of purposes.[2]

[2] E. W. Burgess: "The Growth of the City," Chapter II, in *The City*, by R. E. Park, E. W. Burgess, and R. D. McKenzie, originally published as an article in *Proceedings of the Amer. Sociol. Soc.*, Vol. XVIII, 1923. Another system was originated by the Chicago Census Advisory Committee and members of the Department of Sociology at the University of Chicago about 1940. See Martin W. Reinemann: *The Localization and the Relocation of Manufacturing within the Chicago Urban Area* (Unpublished Ph.D. dissertation, Department of Geography, Northwestern University, 1955).

For purposes of describing the pattern and distribution of manufacturing, four zones, shown in Figure 2, are suggested as follows:

Zone I, The Inner Zone

This zone has an area of about 40 square miles extending from Diversey Parkway on the north to 51st Street and Garfield Boulevard on the south, and from the lake shore on the east to Western Avenue on the west. The "Loop" of Chicago is considered a sector within this zone. In general, the zone is characterized by numerous, diverse, small, and older manufacturing concerns primarily occupying multistoried buildings. Some very large establishments are also present.

Zone II, The Outer Zone

This area surrounds the Inner Zone and includes the remainder of the City of Chicago. Manufacturing is scattered, although many of the plants are grouped in clusters. The zone contains many very large concerns, several of them in

TABLE I

PERCENTAGE OF SELECTED ECONOMIC ACTIVITIES IN THE CITY OF CHICAGO COMPARED WITH THEIR LOCATION IN THE REMAINDER OF THE STANDARD METROPOLITAN AREA, 1947 AND 1954

Activity	*Percentage in City of Chicago*		*Change in percentage*	
	1947	*1954*	*1939—1947–48*	*1947–48—1954*
Population	65.9 (*1950*)	....	−4.5 (*1940–1950*)	....
Manufacturing				
(value added)	69.2	62.7	2.2	−6.5
(establishments)	83.4	76.3	2.6	−7.1
(production workers)	70.4	65.4	−1.5	−5.0
Retail Trade (sales)	72.6	66.6	−3.3	−6.0
Wholesale Trade (sales)	94.8	90.5	−1.5	−4.3
Service Industries (receipts)	85.0	84.6	−2.1	−0.4

Based on 1940 and 1950 *Census of Population*, 1939, 1947, and 1954 *Census of Manufactures*, and 1948 and 1954 *Census of Business*.

multi-storied buildings. A few new single-storied structures have appeared in scattered locations.

Zone III, The Suburban-Fringe Zone

This zone, lying adjacent to but outside of the City of Chicago, contains a number of independent suburban municipalities that form a nearly continuous urban ring about the city. Manufacturing is characterized by both large and small concerns, either newly established or relocated, and for the most part occupying modern one-storied buildings.

Zone IV, The Outlying-Adjacent Zone

This is an area of widely dispersed, satellitic settlements that extends to the outer edge of the Chicago Standard Metropolitan Area. Manufacturing, with few exceptions, is located in the municipalities of Joliet, Aurora, Geneva, St. Charles, Elgin, and Waukegan.

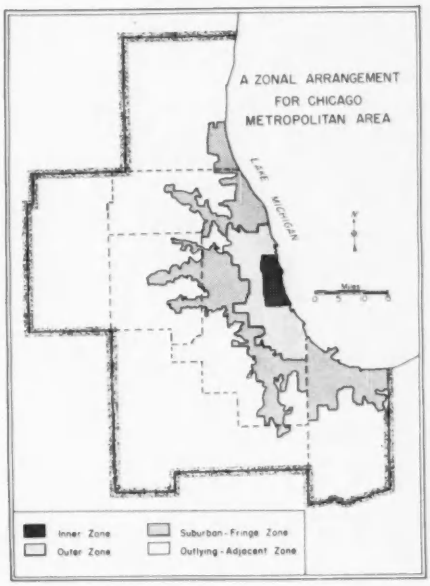

FIG. 2.

The boundary between the Inner and Outer Zones is probably less significant for differentiating local site characteristics for manufacturing than it might be for analyzing other urban characteristics. Although the Inner Zone has many advantages for manufacturers, such as nearness to market, supply houses, and good transportation, the availability of a large labor market, and the general advantage of the high density of manufacturing establishments in closely related lines, it also has many conditions that push industrial development toward the periphery. Some of the relative disadvantages of the Inner Zone are the following: scarcity of land available for industrial use; the generally unattractive and obsolete condition of buildings; and the congested, noisy, and dirty streets with attendant parking and loading problems.

The city limits as the outer boundary of the Outer Zone is important because of the differences in the costs of a variety of community services, including taxes, on the two sides of the line, and the desire to avoid the excessive frequency and undesirable nature of factory inspections, solicitations, and other related political pressures so apparent in the City of Chicago. The boundary between Zones III and IV sets apart those suburbs that are contiguous or immediately adjacent to the city from the detached satellite cities surrounded by rural countryside. This boundary, with few minor exceptions, coincides with that drawn by the Bureau of the Census to mark the outer limits of the "urbanized area." Differences in labor market, availability of public transportation, time and cost of shipping and receiving materials, supplies, and products, and differences in the availability of land and the quality of certain community services distinguish the two zones.

Three publications especially pertinent to this study, all based on the same

source, have revealed the industrial expansion and suburbanization in the Chicago area since 1945.[3] From these three reports, and selected information relative to the first three zones described above, one can discern the general trend of recent industrial relocation in the Chicago Standard Metropolitan Area.

[3] Chicago Plan Commission: *Chicago Industrial Study, Summary Report*, Chicago Plan Commission, Chicago, 1952; Leo G. Reeder: *Industrial Location in the Chicago Metropolitan Area, With Special Reference to Population* (Unpublished Ph.D. dissertation, Department of Sociology, University of Chicago, 1952); Norman E. Brown: "Location of Industries in Chicago and Northern Illinois," *Midwest Engineer*, Vol. 5, No. 2, July, 1952, pp. 2–18. Each of these studies used information from the records of the Territorial Information Department of the Commonwealth Edison Company of Chicago.

GENERAL TRENDS

Industrial expansion within the Chicago Standard Metropolitan Area demonstrated considerable areal differentiation during the period 1941–1950. There

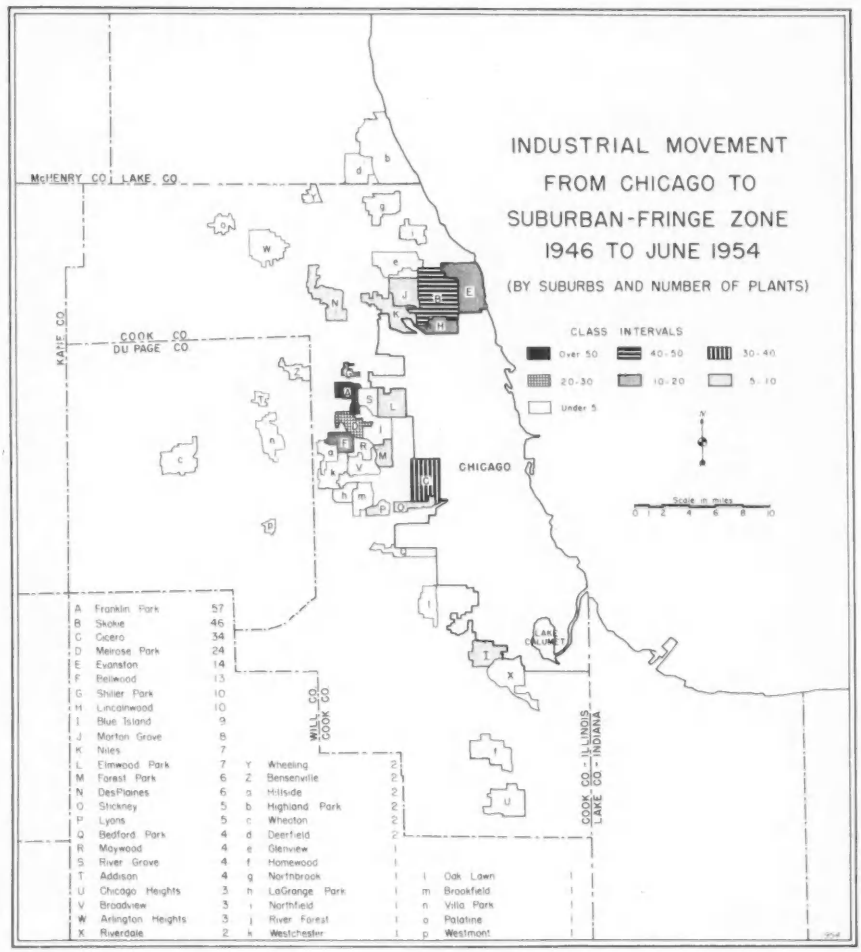

FIG. 3.

TABLE II

MOVEMENTS OF MANUFACTURING ESTABLISHMENTS IN THE CHICAGO URBAN AREA AND INITIAL LOCATIONS OF NEW INDUSTRIES FOR 1941–1950*

Section A. Firms leaving Chicago and moving to Suburban-Fringe Zone

Years	*Inner Zone*	*Outer Zone*
1941–1945	18	37
1946–1950	126	117
Total	144	154

Section B. New industries moving into the three zones**

Years	*Inner Zone*	*Outer Zone*	*Suburban-Fringe Zone*
1941–1945	46	67	113
1946–1950	75	78	332
Total	121	145	445

Section C. Inter-Chicago moves

Years	*Inner Zone to Outer Zone*	*Outer Zone to Inner Zone*
1941–1950	109	12

Section D. Net gain or loss over the decade 1941–1950

Years	*Inner Zone*	*Outer Zone*	*Suburban-Fringe Zone*
1941–1950	Net loss 120	Net gain 88	Gain 743***

*Includes only industries with ten or more employees.
**Includes only those industries new to the metropolitan area.
***Statistics for outmovement from suburbs not available for time period used but for the period 1945–1950 11 plants moved from the suburbs to Chicago and there were six recorded moves from one suburban community to another.

was a net loss of 120 industries in the Inner Zone during this period (Table II), whereas the Outer Zone of the city had a net gain of 88 plants. The Suburban-Fringe Zone, however, showed its attractive nature by a gain of 743 new and relocated industries during this interim. These data emphasize a reversal in the centralizing trend indicated by the 1947 *Census of Manufactures*. For the period 1941–1950 the City of Chicago (the Inner and Outer Zones combined) had a net loss of 32 manufacturing plants.

The latest data available from the Territorial Information Department of the Commonwealth Edison Company of Chicago at the time of this study, show that the industrial suburbanization trend was maintained after 1950 and that it has continued unabated to the present. Between 1950 and 1953, for instance, 201 firms quit Chicago, sustaining the average of about 50 relocations per year first established during the period 1946–1949.

These data also indicate the destinations to which Chicago factories have shifted and afford a basis for showing direction and pattern of the industrial relocation. Of the 446 industries that moved out of the city during the period 1946 through May, 1954, 312 (70 per cent) moved to the Suburban-Fringe Zone, 71 (16 per cent) moved to the Outlying-Adjacent Zone, and 63 (14 per cent) moved to Illinois cities or areas outside the Chicago Standard Metropolitan Area.[4] Figure 3 shows relocations to the Suburban-Fringe Zone, where their concentration in a few suburbs is striking. Five suburbs—Franklin Park, Skokie, Cicero, Melrose Park, and Evanston—received about 53 per cent of the 312 relocated plants.[5] The general pattern of relocation has been to those suburbs adjacent to the City of Chicago, predominantly toward the north and northwest.

[4] No statistics are available concerning moves from Chicago to other states.

[5] The 1954 Census lists 127 establishments for Franklin Park, 115 for Skokie, 170 for Cicero, 75 for Melrose Park, and 130 for Evanston. Obtaining a percentage increase for the period 1947–1954 for the first two cities listed above is not possible because information on their 1947 status is not available. Percentage increases for the latter three were 27, 168, and 55, respectively.

CONCLUSION

Manufacturing in the Chicago Standard Metropolitan Area remains highly concentrated in the City of Chicago despite rapid suburbanization since about 1945. Although there has been considerable relocation of manufacturing plants from the Inner Zone of the city to the Suburban-Fringe Zone, the primary increase in the Suburban Zone represents new industrial establishments. A net gain of industrial establishments in the Outer Zone of the city from 1941 to 1950 suggests that sufficient space and desirable factory sites were still available there during that period. The major direction of both industrial relocation and new industrial development has been toward the northern and northwestern suburbs immediately adjacent to the City of Chicago.

AGRICULTURE IN A RESTRICTIVE ENVIRONMENT: THE CASE OF GREECE

A. A. Pepelasis and Kenneth Thompson

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IN classical times, Greek wealth was largely derived from an economy extending far beyond the homeland. Extensive colonial and trading connections were essential supports of a high level of economic and artistic activity. In modern times, however, Greece has been forced to depend largely on her own limited and imperfectly exploited resources—primarily agricultural.

The economy of modern Greece is undiversified, and exhibits many characteristics of an underdeveloped, foreign-trade-oriented country. Its basic features are as follows:

(1) There is a marked inability to broaden the productive structure of the economy.

(2) There is heavy dependence on foreign markets for a few "luxury" exports. Unprocessed agricultural products account for nearly 85 per cent of the total merchandise exports of the country. Tobacco and dried fruits (mainly currants and raisins) alone compose almost 60 per cent of all export proceeds.[1] On the other hand about 20 per cent of all merchandise imports consist of agricultural products. Tables I and II indicate the relative importance of agricultural exports and imports for two typical recent years.

(3) Industrial development has proceeded slowly and mostly along uneconomical lines, under tariffs and other protection. In 1928, 18 per cent of the Greek labor force was employed in the manufacturing sector of the economy; by 1955 this has increased by only 1 per cent (see Table III).[2]

(4) The principal economic activity is agriculture. About 60 per cent of the total labor force is engaged in primary activities, and the largest single proportion of the net domestic product (about 40 per cent) originates in agriculture (Table I).[3]

During the twentieth century, substantial progress has been made in various sectors of Greek society and economy. However, agriculture remains inefficient, making little progress until recently. Many economic reforms were instituted after 1910 by the Venizelos and other relatively liberal administrations. Some success was achieved by these measures, but, in

[1] Ministry of National Economy, *Greek Trade Bulletin*, No. 15, Athens, 1957, p. 7.

[2] *Ibid.*, p. 7. See also table on occupational distribution for 1907, 1920, and 1928 in League of Nations, *Report to the Council on Greece*, Geneva, 1933; *Annuaire Statistique de la Grèce*, Athens, 1932, pp. 73–77.

[3] Ministry of National Economy, *op. cit.*, p. 7.

TABLE I

EXPORTS, PERCENTAGE OF TOTAL VALUE BY COMMODITY GROUPS—GREECE

Commodity group	*1954 percentage*	*1955 percentage*
Dried fruits	18.2	16.3
Tobacco	40.2	42.0
Other food	9.2	7.8
Crude materials	9.7	17.0
Animal and vegetable oils	6.7	3.2
Manufactured goods	5.4	3.5
All other exports	10.6	10.2
Total	100.0	100.0

Source: Computed from Ethnikē Statistikē Ypēresia, *Statistikē Epetēris tēs Ellados*, 1956, Athens, 1957, pp. 229–231. And Greek Foreign Trade Research Bureau Series: C, *National Economy, Reference No. 5220*, No. 5, Athens, June 30, 1958.

general, the agricultural sector of the economy was only marginally benefited. Agricultural backwardness has persisted and World War II worsened an already bad situation. Greece emerged from it with devastated agricultural resources—land impoverished, livestock decimated—and with pathetically inadequate capital and technology.[4] The low level of agricultural development is reflected in the per capita agricultural income. This is not only low by absolute standards but has long lagged behind per capital national income. It is estimated that in 1911, for example, per capita income for the economy as a whole was 7514 constant 1938 drachmas while per capita farm income was 3732 drachmas. Another estimate placed the per capita income of non-farm workers at 16,848 drachmas in 1938 and that of farm population at 6710 drachmas.[5] The authors have estimated that, with 1938 as the base year, agricultural income and national incomes had risen to 105 and 112 respectively by 1954.[6] In the last few years agricultural incomes have been rising at a somewhat higher rate, but this is primarily due to increased support prices rather than to greater productivity.[7] From such low incomes little is saved. Consequently, agricultural investments are relatively small, not exceeding 4 per cent of the agricultural income.

There is obviously no one reason for the agricultural backwardness of Greece

TABLE II

IMPORTS, PERCENTAGE OF TOTAL VALUE BY COMMODITY GROUPS—GREECE

Commodity group	*1954 percentage*	*1955 percentage*
Livestock and livestock products	6.3	7.9
Cereals	4.3	7.8
Other foodstuffs	5.9	5.7
Fibers	5.1	4.8
Manufactured goods	23.3	20.8
Mineral fuels, lubricants, and related materials	13.8	13.6
Chemicals	9.0	8.4
Machinery and transportation equipment	19.0	21.0
All other imports	13.3	10.0
Total	100.0	100.0

Source: Computed from Ethnikē Statistikē, *op. cit.*, pp. 225–228.

[4] The rate of progress in agriculture between 1948 and 1954 was relatively high. American assistance missions made available technical aid and large amounts of dollars and counterpart drachmas were spent on major agricultural projects, such as reclamation, irrigation, and equipment. In 1948–1954 there were 3,500,000 more stremmas (1 stremma equals 0.247 acre) cultivated with major crops than before the war; output of selected crops representing 85 per cent of the total caloric intake was more than doubled over prewar; and the percentage increases by crops include 144 per cent for pulses, 123 per cent for wheat, 382 per cent for vegetables, and 305 per cent for potatoes. See Walter Packard, Director of Advisory Group on Land and Water Resources Development, *Can Greece Feed, Clothe, and House Its Growing Population* (Mimeographed memorandum to the Greek Government and United States Foreign Operations Mission to Greece), Athens, 1954.

[5] UNRRA Mission to Greece, The National Income and Investment Research Committee, *The National Income of Greece for the Year 1947*, Athens, 1949.

[6] For a detailed discussion of Greek national income see N. Mousmoutes: *Estimate of the National Income of Greece*, Athens, 1959, Tables XI and XIII; also A. A. Pepelasis: *Socio-Cultural Barriers to the Economic Development of Greece*, unpublished Ph.D. Dissertation, University of California, Berkeley, 1954, pp. 54–55 and 90–109.

[7] See an address by X. Zolotas, Governor of the Bank of Greece, on *Monetary Stability and Economic Development*, Athens, 1958, pp. 16–18.

—and, of course, no one remedy. A multiplicity of factors have to be considered. In this paper we propose to examine only some major physical and institutional factors that have prevented a higher rate of agricultural development.

PHYSICAL ENVIRONMENT

While the poverty of the Greek environment has often been exaggerated, it is nevertheless true that the agricultural potentialities of the country are now generally rather limited. However, this was not always so. In the apt lines of Clarence T. Glacken:

> "The reason that Attica in former times could support a soldiery exempt from the toil of farming, says Plato in his *Critias*, was that its soil—as is proved by the remnant now left—surpassed all others in fertility. Deluges, however, washed the soil down from the mountains, and it was lost because the land dropped abruptly into the sea. Attica became a 'skeleton of a body wasted by disease.' Long ago, Plato continues, there were abundant forests, in the mountains which provided fodder for the animals and storage for water, which could then issue forth in springs and rivers. 'The water was not lost, as it is today, by running off a barren ground to the sea.' " . . .[8]

Yet today, the low level of agricultural development can, at least in part, be explained in terms of physical conditions. It is not suggested that Greek topography, soils, and climate are uniformly unfavorable. Far from it, as there are many areas of high agricultural productivity, some relict, and some reclaimed.

[8] Changing Ideas of the Habitable World, in William L. Thomas, Jr. (edit.): *Man's Role in Changing the Face of the Earth*, Chicago, 1956, p. 70.

TABLE III

DISTRIBUTION OF THE GREEK LABOR FORCE ACCORDING TO SECTORS

Sector	*1928 percentage*		*1955 percentage*	
Agriculture and mining	61.5	...	56.5	....
Manufacturing	18.0	...	19.0	....
Services	20.5	...	24.5	....
Commerce	.....	8.5	.....	7.5
Transport	.....	4.0	.....	4.0
Other	.....	8.0	.....	13.0
Total	100.0	...	100.0	....

Source: Ministry of National Economy, *Greek Trade Bulletin*, No. 15, Athens, 1957, p. 7.

Terrain is typically restrictive; most of the country consists of slope land, often very steep, rising to mountains more than 8000 feet in elevation. Generally, these extensive highlands are useful only as low-grade grazing, although lower mountain slopes provide some arable land, and terracing has extended safe cultivation far up many mountain sides. Level, cultivable land is scarce—only one-fourth of the total area—and most is in isolated mountain valleys and discontinuous segments along the coast. The major tracts of cultivable land are in Thrace, Macedonia, and Thessaly. Unfortunately, much of the lowland is in the southeast, where climate is generally least favorable for agriculture.

One of the major enemies of Greek agriculture is drought. Total precipitation at lower elevations is generally moderate, and is subject to great annual variation. Further, average temperatures are warm and evaporation rates are high. Lowland Greece has essentially a Mediterranean type of climate, with mild, rainy winters and long, hot summers, but the irregular terrain produces great local variations in temperature and precipitation. The extensive uplands have cooler, rainier conditions than the lowlands, and may experience freezing weather and snow in the winter.

In general, the west coast is the rainiest, annually averaging 30 to 40 inches of precipitation, and has the mildest winters. Eastern Greece averages about 20 to 30 inches of precipitation annually, and is subject to intense desiccation during the protracted, hot summers. Winters are coldest in the northeast, where rainfall is more evenly distributed throughout the year (Table IV).[9]

TABLE IV

PRECIPITATION AT SELECTED STATIONS IN GREECE

Station	*Mean annual precipitation inches*	*Approximate percentage of total precipitation falling in three summer months*	*Approximate percentage of total precipitation falling in six winter months*
Corfu.....	48.1	4	79
Athens.....	15.5	8	78
Salonika...	21.5	20	54

Source: Data supplied by the National Observatory, Athens, 1958.

A further characteristic of the Greek climate is destructive high winds that recur periodically. The excessively hot, dry south wind known as the *sirocco* occasionally damages crops badly, especially in the eastern and northeastern lowlands.

The relatively dense settlement for many centuries, together with destructive goat and sheep grazing, has led to large-scale deforestation. The principal remaining forested area, mainly coniferous trees, is in the Pindus Mountains, running north-south through west-central Greece. In all, some 15 per cent of Greece is officially classed as forested. About another 18 per cent consists of scrub forest (similar to maquis or chaparral).[10] Steep slopes and a strong seasonally concentrated rainfall predispose much of Greece to accelerated erosion—particularly in deforested regions and where cultivation has been extended up mountainsides without terracing. Surface runoff is rapid under such conditions, accelerating erosion of the slope land and producing great fluctuation in the volume of stream flow.

Much of the better arable land lies on lake plains, flood plains, and deltas. Such lowlands tend to be very level, and inherently marshy—until the advent of DDT after World War II they were also malarial. When temporarily swollen with rapid surface runoff pouring down the mountains, rivers have difficulty in crossing such low-lying areas without overflowing their banks. In consequence, much high-grade farmland suffers damaging floods. Severe flooding—causing destruction of crops, livestock, farm buildings, and capital equipment—was a commonplace occurrence in rural areas until recent conservation measures were introduced.

The rapid erosion of slope land loads rivers and streams with a heavy burden of material. Gravel, sand, and silt may be deposited in sluggish river channels or may be distributed by flood waters over level areas. Initially, such addition of slope land topsoil to valleys and piedmont plains may have been advantageous. However, this surface soil has been followed by subsoil and other material so that land of high agricultural value has been covered with deposits of low fertility.

The lowlands have suffered from erosion as well as from harmful deposition. High winds during summer droughts in overgrazed, fallow, or otherwise unprotected areas have produced much wind erosion on light alluvial soils. In consequence, many lowland farmers are cultivating highly immature soils.

SOIL FERTILITY AND CROPS

In general, Greek soils tend to be

[9] Data supplied by the National Observatory, Athens, 1958.

[10] C. Evelpidēs: *L'agriculture en Grèce*, Les Balkans, Athens, 1934, Vol. V, p. 29; also "Ethnikē Statistikē," *Statistikē Epetēris Ellados*, 1956, Athens, 1957, p. 117.

TABLE V

FERTILIZER USE IN SELECTED COUNTRIES

Country	*Nutrients, pounds per acre*
Greece	3.3
Spain	17.9
Italy	19.4
France	27.5
Germany	78.5
Belgium	123.1
Netherlands	249.4

Source: Food and Agriculture Organization, *op. cit.*, p. 136.

rich in potash but deficient in phosphorus and nitrogen.[11] The need for, and benefits of, artificial fertilization have been repeatedly demonstrated, but little chemical fertilizer is actually used (Table V). For instance, in 1950, only 13 per cent of cultivated acreage received any chemical fertilizer. Lack of commercial fertilizer is not compensated for by the use of animal manure, which is scarce for several reasons. Livestock are relatively unimportant, and grazing them in the highlands during the long summers provides no manure for lowland fields. Furthermore, such animal manure as is collected is sometimes used for fuel rather than fertilizer. Only 3.7 per cent of cultivated acreage received animal manure in 1950.[12]

With little fertilizer used, and with rainfall of low effectiveness, Greek farmers are obliged to practice dry farming techniques and fallow their land. In effect, this drastically reduces the already inadequate arable area. No less than 30 per cent of all arable land was being fallowed in 1950.[13]

Cultivation techniques are rarely designed to improve, or even maintain soil fertility. Indeed, some areas have been cultivated since classical times with minimal regard to the principles of conservational farming. Economic considerations, together with traditionalism and the limitations of the physical environment, have made for little rotation or diversification of crops. Semimonoculture of such crops as cereals and tobacco is widespread. It has often been demonstrated that the relative share of crops in Greece could be profitably changed. Increased output of potatoes, cotton, rice, to name only a few, could bring in higher profit rates than some of the present major crops. But inefficient marketing organization, ignorance of market opportunities, and resistance to accept new methods and crops have created a relatively inflexible production pattern. During the interwar period the proportions of the total cultivated area devoted to the leading crops remained remarkably constant.[14]

In view of these limiting circumstances it is hardly surprising that Greece records some of the lowest crop yields in Europe. A comparison of wheat, barley, and milk yields of 22 European countries gives Greece a low rank for all three (Table VI). Land productivity is not only low but has shown only slight increase during the last 30 years. In the period from 1920 to 1935 it actually fell, among other reasons because of the considerable influx of refugees from Turkey.[15]

The actual crops raised consist mainly of cereals which occupy about half of the cultivated area. Wheat, followed by corn and barley, are the principal grains. Small acreages are devoted to oats, rye, and rice. Tobacco and cotton are the main cash field crops. Other field crops include potatoes, beans,

[11] Food and Agriculture Organization, *Report of the FAO Mission for Greece*, Washington, D. C., March, 1947, Appendix D, p. 135.

[12] Aristides Klēmēs: *Agrotikē Oikonomia*, Academy of Athens, Athens, 1955, pp. 33–47.

[13] Ethnikē Statistikē, *op. cit.*, p. 119.

[14] C. Evelpidēs: *E Georgia tes Ellados*, Athens, 1944, Table VII, p. 185.

[15] G. Coutsoumaris: *Possibilities of Economic Development in the Greek Agriculture*, unpublished Ph.D. Dissertation, University of Chicago, March, 1955, pp. 52–53 and 74.

TABLE VI

AVERAGE WHEAT, BARLEY, AND MILK YIELDS IN SELECTED COUNTRIES, 1934–38, 1950–52

Country	Yields of wheat (quintals per hectar)		Yields of barley (quintals per hectare)		Milk yields (1000 liters per cow per year)	
	1934–38	1950–52	1934–38	1950–52	1934–38	1950–52
Greece	9	10	10	10	0.7	0.7
Belgium	27	33	26	32	3.2	3.6
France	16	18	15	16	1.9	2.0
West Germany	22	27	21	26	2.5	2.7
East Germany		22		18		2.3
Italy	14	16	11	11	1.6	1.8
Netherlands	30	36	28	33	3.5	3.8
Spain	10	9	13	13	1.2	1.4

Source: Economic Commission for Europe and Food and Agriculture Organization, *European Agriculture: A Statement of Problems*, Geneva, 1954, p. 9.

melons, chick peas, tomatoes, and lentils. Tree crops are especially important, consisting mainly of olives, citrus, and other fruits. Grape growing is also a significant source of income (Table VII). Domestic animals are not generally prominent on the Greek agricultural scene, mainly because of a narrow feed base. Sheep and goats are the most numerous livestock.[16]

RECLAMATION

Although Greek farm land suffers greatly from lack of water in summer, irrigation is not well developed. In 1950, only 6.7 per cent of arable land received any irrigation.[17] Most irrigated land is supplied from reservoirs formed behind earth dams. Wells and pumps are also used, generally powered by livestock, but sometimes even hand-operated. Modern mechanical pumps are still uncommon.

Under the pressure of a land-hungry population a policy of land expansion through reclamation was adopted to overcome the shortage of arable land in Greece. It should be noted that per capita land availability has decreased in recent decades, because of a great population growth resulting from natural increase and refugee influx. During the period 1920–1940, an estimated 1,125,000 acres were brought under cultivation through flood control, drainage, and irrigation projects. Major reclamation works were carried out in the Strimón Valley and Drama Plain, Axiós Valley, Piniós Valley, and Arta Plain. In addition, 2,600,000 acres, mainly low-grade and slope land, were brought under cultivation between 1925 and 1940. Despite the reduction of pasture this entailed, the numbers of livestock increased during these years. In all, crop land area was more than doubled during the inter-war period, while farm labor supply increased by

TABLE VII

LAND USE—GREECE

Category	Acres	Percentage
Annual crops	6,296,030	19.4
Tree crops	725,686	2.2
Vines	483,626	1.4
Meadow	101,517	0.3
Lowland pasture	732,849	2.2
Lowland forest	565,877	1.7
Upland pasture	12,542,166	38.3
Upland forest	4,836,507	14.8
Buildings, roads, and internal waters	644,670	1.9
Unused	5,813,886	17.8
Total area	32,742,814	100.0

Source: Ethnikē Statistikē, pp. 117–131; Klēmēs, *op. cit.*, pp. 26–27.

[16] Ethnikē Statistikē, *op. cit.*, p. 125.
[17] Klēmēs, *op. cit.*, pp. 40–52.

only one-third.[18] Between 1948 and 1954, about 175,000 acres of new land were added to the cultivated area, mainly through drainage and brush clearing. In addition, over 1,250,000 acres were made more productive by flood control, drainage, and irrigation measures. This post-war land improvement was largely promoted through American aid programs. More reclamation remains to be done and some extensive schemes are under consideration. Officials estimate that at least 1,250,000 acres can be brought into cultivation through further clearing, drainage, terracing, and alkali control.[19]

Although reclamation works made cultivable some fertile alluvial land and increased the productivity of other areas, much of the new land supply was in marginal, relatively infertile regions. The reclamation program was not dictated entirely by economic considerations but was partly inspired by a policy of autarchy. This intensified the high cost structure of Greek agriculture. The maintenance of high agricultural costs burdening the masses of consumers was made possible by a policy of strict protectionism. In 1939, for example, the support price of domestic wheat was more than double the price of imported wheat before duty.[20] Most of the "benefits" of such protection were, however, lost in a spiral of over-all protectionism. Fertilizers, machinery, and items that constitute inputs in the agricultural production were either unaccessible or imported under heavy tariffs. The pre-existing rigidity in the pattern of utilizing agricultural resources was further increased by these protective measures and the absence of a well-designed policy to encourage diversification of agricultural exports.[21] As the largest proportion of Greek exports are agricultural products with high demand elasticity that during the last half century have been exposed to adverse demand and world price conditions, inflexibility in the productive structure of agriculture has been a source of additional strains in the balance of payments.

[18] Coutsoumaris, *op. cit.*, pp. 33–34.

[19] Packard, *op. cit.*, Tables IX and XIII.

[20] C. Evelpidēs: *E Chronia Georgikē Krisis*, Athens, 1953, p. 78; also X. Zolotas: *Agrotikē Politikē*, Athens, 1934, pp. 276–284.

INSTITUTIONAL ENVIRONMENT

Richness in resources is not, of course, a fixed quantum of naturally endowed wealth for man's potential use or neglect. It is more a matter of technology as well as of individual and collective initiative. There are numerous examples, with Denmark and Switzerland probably the most obvious, in which human drive for economic development, in suitable historical circumstances, has overcome all but the most gross resource deficiencies. Although Greece must undoubtedly be ranked among the poorer nations of Europe, its resources are not inconsiderable. These include some mineral wealth, fisheries, water for power and irrigation, and certainly greater agricultural resources than the present condition of agriculture might suggest. The Food and Agricultural Organization Mission to Greece reported that:

> Greece has resources and people capable of sustaining far higher productive levels than those so far attained. The country can very materially increase its per capita production and national income, probably to double or triple its present level within two or three decades.[22]

[21] G. Coutsoumaris: "Possibilities of Economic Development in a Short-of-Land Agriculture," *Economic Development and Cultural Change*, Vol. IV, No. 4, Chicago, July, 1956, p. 389.

[22] Report of the FAO Mission to Greece, *op. cit.*, p. 3. Similar views were expressed by

(*Continued on next page*)

Development of these resources has been limited for many reasons. Important among these have been the country's institutional milieu and value systems, within which all economic activity occurs. A comprehensive study of non-economic influences that have impeded economic development would have to include many factors—for example, domestic political conditions in the nineteenth century that resulted in gross misuse of capital for military adventures rather than productive investments; or lack of effective political independence from foreign powers.

Cultural attitudes among the Greeks have not traditionally given high priority to material development. The Renaissance touched only the periphery of Greece, and the organizational patterns associated with the Reformation had virtually no contemporary influence. The Greeks did not participate fully in the realignment of economic outlook that occurred in western Europe after the Industrial Revolution. Indeed, rural Greece until a few decades ago was more or less under the influence of Ottoman traditions with respect to economic and social life, and under the indirect influence of medieval Byzantine concepts of resignation and contempt for worldly affairs.

Apathy and acceptance of poverty as the natural lot of the majority of the peasants was compounded by a long period of foreign oppression, frequent wars, and maladministration. Consequently, a spirit of defeat or futility of effort and reluctance to plan ahead was created. It is not that Greeks are hostile to technical progress and material wealth. Rather, they are so suspicious of new processes and new methods, and so used to perennial frustrations they do not anticipate material advance. Such limited expectations are not inducive to departure from ways of life emphasizing traditionalism. A moderate standard of living is sought, and everything beyond this is to be enjoyed rather than used for the creation of further wealth.

Long periods of poverty, of frustrated aspirations, of inefficient centralized administration, and of government largely indifferent to the promotion of economic development have filled the farmer with deep mistrust and suspicion.[23] He will not adopt new techniques and new methods unless they are repeatedly shown to be beneficial. He will not accept readily the advice of the agricultural extension expert because he represents a government agency. He will not invest in a new crop or a new seed variety because long experience has taught him that the farmer's efforts will be eventually in vain. The Crete Survey of the Rockefeller Foundation found that, in most cases, less than one-tenth of the Cretans interviewed who had heard about new high yielding crop varieties has actually adopted them.

Considering the low living standards, division of time between work and leisure generally emphasizes the latter. Again this may be illustrated by the example of primarily agricultural Crete. Here it has been shown that each male member of a rural community spends excessive time per week in coffee houses, playing cards, arguing politics, or in

A. Agelopoulos in *To Ellenikon Oikonomikon Problēma*, Athens, 1944; also High Board of Reconstruction, *Memorandum on the Long Term Programme for Greece*, Athens, 1950, p. 9.

[23] It is important to note that at present the Greek Government is seriously involved, for the first time, with the problems of economic development of the country. Economic progress has become the central issue and serious efforts are being made for its promotion. The Research Bureau of the Bank of Greece, staffed with the ablest economists of the country, and other agencies are now studying with sophistication aspects of long-run developmental plans.

contemplation, while sipping Turkish coffee. Table VIII, which shows the large proportion of coffee houses in relation to other business establishments, indicates the prominence of such leisure centers. Before World War I the Greek church dedicated almost half of the year to religious holidays. It has been estimated that Thessalian peasants used to work only about 170 days each year. Landlords encountered difficulty in making them work even 200 days.[24] There are still about 35 church and state holidays annually, excluding Sundays.

Although it is true that much unproductive use of time results from unemployment and underemployment, the widespread inactivity partly reflects poor motivation in regard to work. People with relatively low incomes, who may remain unemployed for long periods during the year, rarely engage in activities which could improve their level of living, such as cultivating vegetable gardens. Travellers in the Greek countryside were often struck by a dilapidation of houses, farm buildings, and other structures that could be corrected mainly by simple labor.

Indeed, manual work is looked down upon. A high school graduate, for example, to say nothing of the college trained, will seek only office work. Even graduates of agricultural schools tend to avoid the practical side of farming, looking for careers in government, agricultural business, or administration.

This pattern of values is reflected in, and partly contributed to, the Greek education system. Education has emphasized esoteric values and has been oriented away from pragmatism, certainly technology, and largely preoccupied with the classical and Byzantine past. This emphasis is apparent even in what specialized and vocational education there is in Greece. Technical education has been neglected and in this essentially agricultural country there were until recently twice as many military schools and about three times as many art schools as agricultural educational institutions.[25] Actually, the situation was much worse than these comparisons may suggest since some of the agricultural schools operated irregularly on Sundays and holidays. Some did not even have their own buildings.

TABLE VIII

BUSINESS ESTABLISHMENTS PER 1000 INHABITANTS, CRETE, 1948

Types of business	*Villages*	*Cities*	*All Crete*
Coffee shops	8.2	5.7	7.7
Grocery stores	2.7	5.4	3.2
Butcher shops	3.4	1.5	3.0
Tailor shops	2.0	3.9	2.4
Taverns	1.4	1.8	1.4
General stores	1.5	.7	1.3
Blacksmith shops	1.0	1.4	1.0
Restaurants	.5	1.1	.6
Bakeries	.2	1.1	.4
Pharmacies	.1	.3	.1
Barber shops	2.1	2.6	2.2

Source: Allbaugh, *op. cit.*, p. 180, Table 25.

Moreover, even schooling of the nontechnical type is restricted. Even by the apparently optimistic estimates of the United Nations, about 24 per cent of the population (aged ten years and over) are illiterate. As is generally the case, illiteracy is greatest among the population of rural areas. Thus, for example, in Crete in 1948, 30 per cent of the heads of households had had only six years of education, and a mere 2 per cent had had twelve years.[26] The direct relationships between educational standards and agricultural efficiency is well known, and has been clearly demonstrated by numerous studies.[27] The low standards of Greek

[24] D. Zographos, in *Akropolis*, Athens, May 3, 1919.

[25] Royaume de Grèce, *Statistique de l'enseignement*, Partie C, Athens, 1939, p. 9.

[26] A. L. Allbaugh: *Crete: A Case Study of an Underdeveloped Area*, Princeton, 1953, p. 522.

[27] G. Pond and W. Willcox: "A Study of the Human Factor in Farm Management," *Farm*

(*Continued on next page*)

agriculture must be partly explained by lack of general and technical information among its farmers. In the last few years there has been some progress in the direction of vocational and technical training, but the legacy of past inadequacies and educational prejudices still remains.

The government throughout the nineteenth century and up to 1910, neglected almost entirely agriculture and the farmers. The administration of agriculture was not in the hands of an independent and separate department until 1917, when the Ministry of Agriculture was established. In the inter-war period some efforts were made to modernize and assist agriculture but they were unsystematic and were inspired by short-run political considerations and a policy of self-sufficiency. Agricultural credit was practically unavailable to the small farmer until agricultural cooperatives were established in the 1920's. In addition, there was a conservative, rigid, and formalistic legal system, evolved under conditions much different from those prevailing in the Greek economy, which did not offer an environment conducive to development of credit institutions or general progress and generally to agricultural growth.

Another set of institutions which must have exerted a negative influence on agricultural efficiency relate to farm size and fragmentation. As Greece has an area of 51,161 square miles (32,742,814 acres), of which 27.2 per cent (8,905,585 acres) is officially classed as cultivated and the population is 8,031,013 (1956 estimate), there is an average of only 1.1 acres of cultivated land per person. Of course, such population density figures have little significance unless examined in the light of technical and productive differences. However, there is value in a comparison of agricultural acreage per capita among areas of general similarity. In the Balkan countries, which form a region of some unity, economic and otherwise, Greece has the lowest agricultural acreage per capita (Table IX).

According to the 1950 Agricultural Census each member of the Greek farm population had an average of only 1.6 acres of cultivated land at his disposal. In the same year the number of agricultural units was 1,006,937. The average farm was only 7.7 acres in size. Over 82 per cent of the agricultural population lived on farms smaller than 12.3 acres (50 stremmas) (Table X). The smallness of farms is partially the result of agrarian reforms completed in the 1920's, in which large estates and newly reclaimed lands were subdivided and given to landless peasants and political refugees from Turkey. These reforms sought to satisfy land hunger and serve social ends rather than increase output per unit of land. The outcome was excessively small holdings that have in the long run reduced the marketable surplus of foodstuffs per unit of land and therefore have not facilitated transfer of manpower to urban occupations. Small farms have also been encouraged by Greek inheritance and

TABLE IX

CULTIVATED LAND PER CAPITA IN BALKAN COUNTRIES

Country	*Acres*
Greece	1.2
Bulgaria	1.5
Turkey	1.4
Rumania	2.3
Yugoslavia	2.3

Source: Evelpidēs, *Oikonomia tēs Ellados*, Athens, 1944, pp. 21-22.

Economics, 1932; also W. Willcox and O. Lloyd: "The Human Factor in the Management of Indiana Farms," *Purdue University Bulletin*, No. 369, 1953; and F. Baade: "Brot für ganz Europe," and "Die deutsche Landwirtschaft als Partner in einer europäischen Agrargemeinschaft," in *Gutachten zu Fragen einer europäischen Agrargemeinschaft*.

dowry laws, which operate to disperse farm holdings. And, further, large farms are actually prohibited under Greek law, which does not permit individuals to own more than 75 acres of cultivable land.[28]

Compounding the evils of small farm size is the fragmentation of farm units. In 1950 there were no less than 6,592,049 land parcels, averaging 1.2 acres each. Each farm averages 6.5 separate lots. The degree of farm fragmentation varies greatly from region to region. Crete, for example, is particularly badly off in this respect with an average of 12.7 lots per farm. Peloponnesus is another region of severe fragmentation. Land fragmentation has worsened since 1929, when the average farm consisted of only 5.6 parcels of land.[29]

Small and fragmented holdings are very wasteful of land. Farm enterprises are too small for rational patterns of production, while fragmentation increases the need for capital, draft animals, implements, fences, and other capital outlays. They also obstruct cooperative production activities between small farmers with limited capital funds. Furthermore, scattered fields waste the farmer's time and effort in moving from one lot to another, usually without any mechanical transportation.[30]

Given the level of technology in an economy and the general economic conditions of the farmer, small-sized and fragmented farm units, and predominance of slope land, militate against mechanization of agriculture. Thus, use of agricultural machinery in Greece is still extraordinarily limited—despite imports of farm machinery recently made possible by American aid. According to the 1950 Agricultural Census only 1.6 per cent of all farms employed mechanical power—and over 26 per cent used no power at all, mechanical or animal. Furthermore, with a preponderance of tiny farm units and limited supplementary opportunities in non-agricultural pursuits, full-time agricultural employment is often impossible for the majority of the farm population. Accordingly, rural underemployment is widespread. It has been estimated that, in 1953, about 450,000,000 "wage days" were available in agriculture, but only some 300,000,000 were actually used.[31] Although underemployment estimates are largely arbitrary, depending on the availability of data and their interpretation, the figures above are some indication of surplus rural labor.

TABLE X

FARM SIZE—GREECE 1950

*Total size in stremmas**	*Farm population supported*	*Number of farms*
0–1	52,293	10,388
1–10	1,106,611	276,718
10–50	2,769,938	573,198
50–100	644,289	114,327
100–200	155,771	25,912
200–500	34,229	5,361
500–1000	4,292	651
1000–2000	2,248	265
2000–5000	792	82
over 5000	410	35
Total	4,770,873	1,006,937

*1 stremma equals 0.247 acre.

Source: Computed from Agrotikē Trapeza: *Deltion No. 99*, Athens, Nov., 1957, p. 15.

CONCLUSION

If Greece is to succeed with her plans for economic development and raise levels of living, some institutional changes will be necessary. Furthermore, economic development must begin with increased agricultural productivity—per man-hour and, even more

[28] C. Evelpidēs: "Some Economic and Social Problems in Greece," *International Labor Review*, Vol. LXVIII, Geneva, 1953, p. 153.

[29] Ethnikē Statistikē, *op. cit.*, p. 118.

[30] The average walking time for a Cretan farmer is 10 minutes to his nearest lot, and 90 minutes to the farthest. See A. L. Allbaugh, *op. cit.*, p. 539.

[31] *Deltion Agrotikēs Trapejēs* (Bulletin of the Agricultural Bank), 1957, No. 99, pp. 15–16.

important, per unit of land. Higher land productivity may of course be achieved, at least initially, simply by employing better agricultural techniques. Improved seed strains, crop rotation, greater fertilization, simple implements and equipment, and more efficient methods of distribution and marketing will undoubtedly raise farm output per acre, which may support capital accumulation and development projects. These improvements can be introduced without necessarily abandoning the present labor-intensive farm system. The argument has often been made that, in over-populated peasant countries (such as Greece), advances in farming techniques are not a logically primary condition of economic advance.[32] In this view the problem is rather how to mobilize the saving potential that is concealed in unemployment. It is argued that in the case of a dense rural population, there is an opportunity for increases in domestic savings by transferring some surplus population off the land and to capital projects. On the other hand, in the case of sparsely populated areas, increases in agricultural productivity should have priority over everything else. Here formation of capital depends on the rate at which improvements in agriculture will release manpower. A given percentage increase in productivity here will have a far greater effect on the absolute amount of labor released for capital formation than a similar percentage improvement in, say manufacturing or the service industries.

Even if there were only these two extreme alternatives for increasing output per man (through labor productivity or land productivity) and generating a process of capital creation, this model, in spite of its general plausibility, would not be realistic in the case of Greece. Economic progress in that country depends on the primary condition of agricultural improvements that must precede further capital formation and development of the non-agricultural sectors of the economy. This statement may be supported as follows:

Firstly, there has always been unemployment among Greek industrial workers. This surplus labor can be mobilized more easily than the rural counterpart for capital formation projects.

Secondly, although Greece is an agricultural country, it has consistently depended on foreign sources for a large proportion of its basic food requirements. The possibilities of expanding Greek non-agricultural exports to pay for food imports are limited. Capital formation and development would have to depend to a large extent on the rate of increase in food supplies. In other words, increasing output per man through reduction of labor in agriculture is not sufficient. Increased total food output—increased productivity per unit of land—is necessary to sustain a program of capital formation and economic development, assuming no substantial flow of foreign capital. Even assuming that the marginal product of the surplus farm labor is negligible, so that withdrawal of surplus labor will not affect total output seriously, increased monetary demand (which, given the inefficiency of Greek fiscal administration, has not been easy to restrain) may be reflected in higher expenditures on food and other imports, thus presenting new strains on a chronically weak balance of payments. This has happened before, and it may again reduce the possibility for successful capital formation projects.

Under popular pressures and governmental direction Greece is now engaged

[32] Ragnar Nurkse: *Problems of Capital Formation in Underdeveloped Countries*, Oxford 1953, pp. 52–55.

in considerable long-run programs of development. It seems imperative that these succeed, in view of recent rapid population growth and tense social expectations for a higher level of living. But, a note of caution and, perhaps, pessimism is in order. Most of the development programs are designed with a clear bias in favor of industrialization and considerable resources are being invested in the non-agricultural sectors. There are no indications that Greek public policy for economic growth is guided by productivity criteria. In the writers' opinion, Greek developmental policy should be directed primarily toward agriculture and those industries that provide agriculture with its inputs (e.g., fertilizers) or that process agricultural output. Of course, industrial development, outside the primary sectors, should be encouraged where domestic demand and cost conditions are likely to make for viability. These remarks may assume an increased relevance if and when a European economic union becomes a reality.[33] Greece would then have to undergo an extensive reorientation in the pattern of her resource allocation. There will be additional pressures on agriculture to become more competitive in the greater unified European market. Greek exports of agricultural goods might then be enlarged in exchange for expanding imports of some industrial goods that Greece could no longer produce domestically. Greater agricultural productivity will be essential if even a moderately rising level of living is to be attained.

ACKNOWLEDGMENTS

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[33] Recent press reports suggest that the Greek government is seriously considering the possibilities of joining the European Common Market. See *Oikonomikos Tachydromos*, No. 15, Athens, October 23, 1958.

AREAL ASSOCIATIONS BETWEEN POPULATION GROWTH AND SELECTED FACTORS IN THE CHICAGO URBANIZED AREA

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WITHIN the body of theory developed by the discipline of geography is the notion of areal association. This notion appears to derive from geography's early interest in the functional relationships between phenomena which are distributed unevenly over the earth's surface.[1] The major ideas of areal association have been formulated clearly by McCarty, *et al.*, and have been presented in operational terms within the quantitative framework provided by regression and correlation analysis.[2] Briefly, correlation-regression may be described as an analytic system by which many observations for two or more phenomena are generalized in terms of the functional relationships which obtain between one of the variables and the others. In general, the present investigation is formulated within the conceptual framework provided by areal association and proceeds empirically by means of regression and other statistical techniques. Because the study involves spatially and temporally restricted generalizations, it is designed so that it can be duplicated for other areas and other time periods.

That the population within the cities that surround the more populous municipalities in the United States has not grown by equal amounts is well known. Furthermore, it is a characteristic of cities that each may be defined in terms of an unique location. Thus, the geographer is provided with a spatial distribution for analysis and explanation.[3] It is from these considerations that the present study derives. Specifically, the investigation attempts, by means of hypotheses formulated in quantitative terms, to account for spatial differences in the amount of population growth which occurred (in the decade from 1940 to 1950) in 86 outlying cities located within the Chicago Urbanized Area (Fig. 1).[4]

The hypotheses of areal association were tested within the Chicago Urbanized Area because it offered advantages not found in other places. First, the Chicago Urbanized Area was convenient for study. Its nearness appreciably lowered the costs of field inspection from which the hypotheses were formu-

[1] Richard Hartshorne: "The Nature of Geography," *Assn. of Amer. Geogrs.* Lancaster, Pa., 1939, pp. 71–82.

[2] H. H. McCarty, *et al.: The Measurement of Association in Industrial Geography*, Department of Geography, State University of Iowa, 1956, pp. 1–7.

[3] Sten DeGeer: "On the Definition, Method and Classification of Geography," *Geografiska Annaler*, 1923, pp. 1–37.

[4] Thirty-one outlying cities were excluded from the investigation because data for them were not available. Information was unavailable for either of two reasons: (1) the city had a population of less than 1000 inhabitants in 1940 or (2) it was not incorporated in 1940.

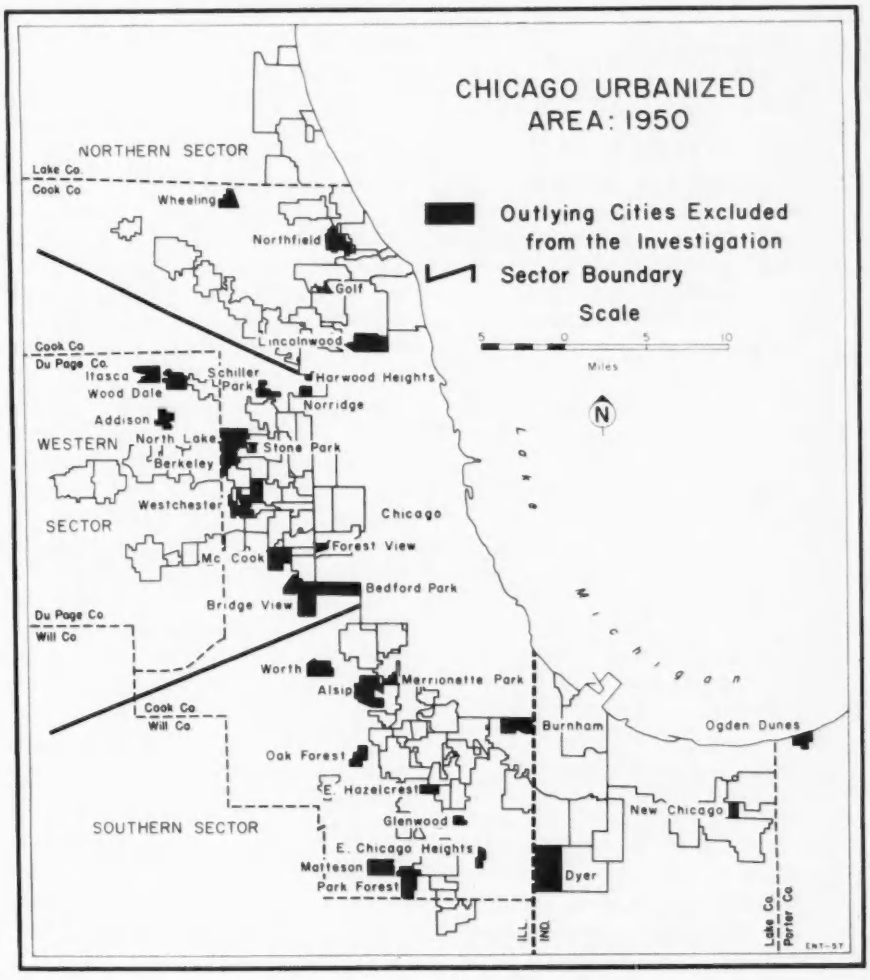

FIG. 1. Chicago Urbanized Area: 1950.

lated and lessened the expenses incurred while collecting the data needed to evaluate the hypotheses quantitatively. Second, there are many phenomena distributed within the Chicago Urbanized Area and these show marked variations in magnitude in different outlying cities, e.g., there are no manufacturing plants within the municipal limits of some outlying cities whereas within others there are many manufacturing establishments. This complexity and variation permitted the testing of a greater number of hypotheses concerning the spatial distribution of population growth than would have been possible in an area in which outlying cities were more homogeneous. Because the study involves spatially and temporally restricted generalizations, it is designed

so that it can be duplicated for other areas and time periods.

DEFINITION OF VARIABLES AND COLLECTION OF DATA

The major focus of this study is to understand, through the use of a set of variables logically related to population growth, the spatial variation in the magnitude of population growth which occurred in the outlying cities of the Chicago Urbanized Area. In this study, the population growth occurring in a given outlying city is defined as the numerical change from 1940 to 1950 in the number of persons whose usual place of residence or usual abode is within the municipal limits of that city.[5]

The following factors, relating to conditions within the outlying cities as of 1940, are hypothesized as related areally to population growth: (1) size of the population; (2) density of the population; (3) cost of housing; (4) birth-death differential; (5) age; (6) quality of the schools; (7) number of persons engaged in manufacturing; (8) accessibility from the central city; and (9) amount of vacant land. In addition to the variable factors listed above, it is further hypothesized that regional differences in population growth exist and that recognition of those differences aids in understanding the spatial pattern of population growth. Hence, the Chicago Urbanized Area is divided into three sectors: Northern, Western and Southern (Fig. 1).

There is need in a study of this type to define specifically the variables which are being investigated and the sources from which information is taken to clarify the basic components of the study and to provide a partial basis for evaluating any conclusions that are reached.[6] However, the sources of information and definitions applied to four factors warrant only brief discussion. The regional division of the Urbanized Area is not defined in greater detail because the segmentation used in the study is clearly delimited in Figure 1. Similarly, the first three variables listed above are given little elaboration, primarily because they appear commonly in geographic literature but also because they are defined precisely by the United States Bureau of the Census. Briefly, the size of the population of a given outlying city is defined as the number of persons whose usual place of residence or usual abode is within the municipal limits of the city; density of the population within an outlying city is defined as the ratio between the population size and the area of that city; and the cost of housing within an outlying city is defined as the value of the average rent within that city.[7]

Variables 4 and 5, the birth-death differential and the age of an outlying city, receive greater elaboration because they appear less frequently in geographic literature. The birth-death differential for a given outlying city is defined as the difference between the number of births and the number of deaths occurring to the resident population of that city. These data for cities

[5] U. S. Bureau of the Census, *Sixteenth Census of the United States: 1940*, Population, Vol. 1, 1942; and *Seventeenth Decennial Census of the United States; Census of Population: 1950*, Vol. 1, 1952.

[6] Herbert L. Searles: *Logic and Scientific Methods*, New York, 1948, pp. 139–151; Herman H. Goldstine and John van Neumann: "Numerical Inverting of Matrices of High Order. II," *Proceedings of the Amer. Math. Soc.*, Vol. 2, pp. 118–204. In both references is found a discussion of the sources of error in quantitative studies.

[7] The population size of an outlying city is available in Volume I of the *Sixteenth Census: 1940. Population, op. cit.* The area of the outlying municipalities is available in *Areas of the United States, 1940*, also prepared by the Bureau of the Census. Values of the average rent are available in *Sixteenth Census of the United States: 1940. Housing*, Vol. I.

with greater than 10,000 population are available from the Bureau of the Census and the Public Health Service.[8] The same information for smaller cities is compiled from tabulation sheets and original certificates of birth and death from the state boards of health. The age of a given outlying city is defined as the number of years between the date of incorporation and January 1, 1940. These data are available from the Office of the Secretary of State of Illinois, *The Columbia Lippincott Gazetteer of the World*, and interviews with municipal officials.[9]

The remaining variables (6 through 9) require more careful consideration, primarily because of their operational definitions. Because of arbitrary decisions, a statistical relationship between population growth and these factors may not be indicated whereas one might be forthcoming if the hypothetical factors were redefined. The operational definitions and sources of information for these factors are discussed in the following paragraphs.

Variable 6, the quality of schools, is defined for the purposes of this study as the ratio of students to teachers in the elementary schools of an outlying city. This ratio is used as a direct index of school crowding and by inference, as an index of the general quality of the schools. The implicit assumption in the student-teacher ratio, that the quality of the schools decreases as crowdedness increases, appears warranted, other things being equal. The various student-teacher ratios are based upon data from the elementary school systems rather than upon data from elementary and high schools because the data for elementary schools are more representative of the situation obtaining in individual cities.[10]

Variable 7, the number of persons engaged in manufacturing, also deserves clarification. This variable is measured as of 1951 whereas other variables are measured for 1940. Selection of 1951 as the year for which to measure the number of employees engaged in manufacturing is based upon practical rather than theoretical grounds. Reliable data for the smaller cities are not available for any earlier period.[11] Thus, persons engaged in manufacturing must be measured as of 1951, or for some more recent time, or not be included in the analysis. Inasmuch as the spatial distribution of manufacturing has logical relevance to the distribution of population growth, it was considered desirable to include it.

Variable 8, accessibility from the central city, also deserves clarification. Distance, time, and cost are elements of accessibility, and distance, in terms of time-cost, appears to be its most logical measure. But in almost every outlying city there are available several kinds of commuter transportation and associated with each type are markedly different times and costs into Chicago. Unfortunately, data for weighting these times and costs, so as to arrive at an estimate of accessibility which is objec-

[8] U. S. Bureau of the Census, *Vital Statistics of the United States: Part II. Place of Residence* for 1940 through 1944; and Public Health Service, *Vital Statistics of the United States: Part II. Place of Residence* for 1945 through 1949.

[9] *Counties and Incorporated Municipalities of Illinois*, (Office of the Secretary of State, Springfield, 1941) and *The Columbia Lippincott Gazetteer of the World*, Morningside Heights, N. Y., 1952.

[10] The student-teacher ratios for Illinois cities are computed from data compiled from the *Illinois School Directory* (Office of the Superintendent of Public Instruction, Springfield, 1939) and the *Directory of Cook County Schools, 1939–1940* (Office of the Superintendent of Schools, Chicago, 1939). The same data for cities in Indiana are from the *Indiana School Directory*, 1939–1940 (Office of the State Superintendent of Public Education, Indianapolis, 1939).

[11] Donohue's Directory of Manufacturers and Processors (Donohue Directories, Inc., Chicago, 1952).

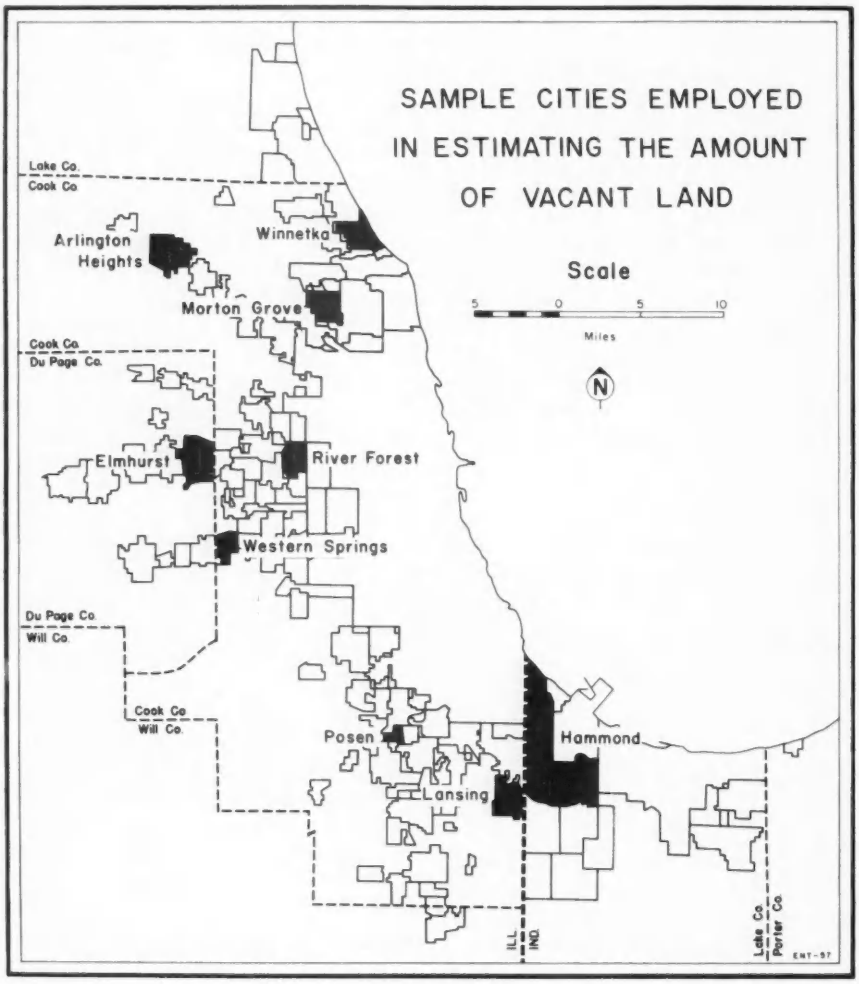

FIG. 2. Sample cities employed for estimates of the amount of vacant land within an outlying city.

tive and consistent for all outlying cities, are not available. A substitute measure was needed, and in this study the accessibility of an outlying city is defined as the airline distance between the Chicago Central Business District and the geographical center of that city. Although airline distance does not embody all aspects of the concept of accessibility, it does provide an operation definition which is at the same time objective, precise, and subject to uniform application to every outlying city.[12]

The amount of vacant land within

[12] The following map sources were used in determining the airline distance: *General Highway and Transportation Map for Illinois*, for Cook, Du Page and Lake Counties (Department of Public Works and Buildings, Springfield, 1940); *Chicagoland Map* (Chicago Tribune, Chicago, 1942); and *The Map of Lake County, Indiana* (Office of the Lake County Surveyor and Engineer, Crown Point, Ind., 1950).

an outlying city is the remaining variable needing elaboration. Determining the amount of vacant land within each outlying city involves an estimate based upon a sample. For this reason, the general procedure which was followed is described. First, a random sample of cities was selected for the 86 outlying municipalities (Fig. 2). Next, the amount of land used for urban purposes in each sample city was estimated from aerial photographs. The amount of land used for urban purposes then was correlated with the number of structures found in each city in the sample group and the resulting regression equation was used to expand the sample (Fig. 3). The estimated amount of area used for urban purposes was subtracted from the total area of a given outlying city to secure an estimate of the vacant land within that city.[13]

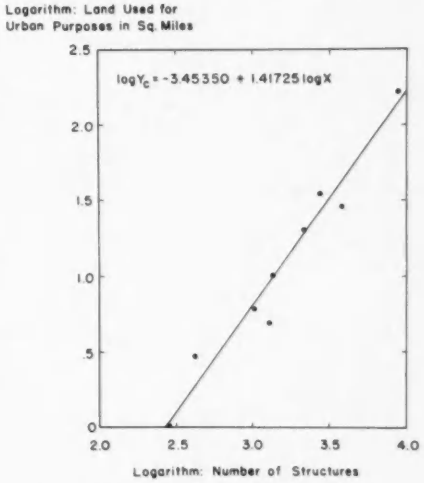

FIG. 3. The land used for urban purposes and the number of structures in nine sample cities.

STATISTICAL DESIGN

Multiple and simple regression were the basic statistical techniques employed in estimating the relationships between population growth and the selected factors.[14] Population growth was the dependent variable; the phenomena hypothesized as associated with it were the independent variables. Whether the hypothetical associations were statistically significant or merely chance occurrences was determined by using F tests, z tests and t tests. For these, "normal" probability limits were applied. Furthermore, linear models were employed throughout the regression analyses. Whenever necessary, the data were transformed to fulfill the "normal" probability limits. The relative success of each transformation was determined by inspecting a fractile diagram on which the cumulative frequency of observations for each variable is portrayed (Fig. 4).[15]

FACTORS AREALLY ASSOCIATED WITH POPULATION GROWTH

The areal associations between population growth and the independent variable were measured by simple and multiple regression. The results of the simple regression analyses were interpreted in accordance with the results of the multiple regression analyses. For this reason, and because of space limitations, the results for simple regression

[13] The aerial photographs are from the Aerial Photographic and Engineering Service, Production and Marketing Administration, U. S. Department of Agriculture. The photographs were taken in 1939 and 1940. Data for the number of structures in each city are from the *Sixteenth Census: 1940. Housing, op. cit.*

[14] The writer wishes to acknowledge the financial support of the National Science Foundation, Contract G-5008, which made possible the computation of the numerous statistical values needed in the study on the IBM 650 computer at Northwestern University.

[15] Two transformations were employed in this analysis. In one, logarithms of the observed numbers were employed rather than observed numbers; in the other, logarithms of the square roots of the observed numbers were used. The latter transformation was suggested by Dr. William C. Krumbein, Professor of Geology, Northwestern University.

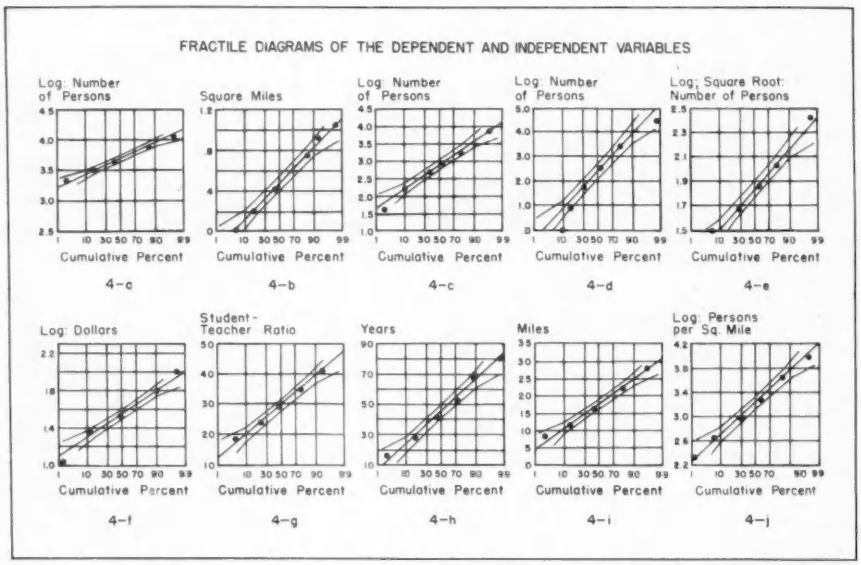

FIG. 4. Fractile diagrams of the dependent and independent variables. The following symbols appear on the graph: 4-a, population growth; 4-b, amount of vacant land; 4-c, birth-death differential; 4-d, number of persons engaged in manufacturing; 4-e, size of the population; 4-f, cost of housing; 4-g, quality of the schools; 4-h, age of an outlying city; 4-i, accessibility of an outlying city; 4-j, density of the population.

are presented below with no elaboration. In spite of this restriction, it should be emphasized that valuable insight into the problem was secured from them, particularly during the final phases of the analysis when new hypotheses were being formulated. Three limited generalizations arise from the simple regression analysis (Table I):

1. Outlying cities with greater positive differences between births and deaths experienced, on the average, greater population growth from 1940 to 1950 than cities which had smaller positive differences.
2. Outlying cities with greater numbers of persons employed in manufacturing experienced, on the average, greater population growth from 1940 to 1950 than cities in which there were fewer persons engaged in manufacturing.
3. Outlying cities with larger amounts of vacant land experienced, on the average, greater population growth from 1940 to 1950 than cities which had smaller amounts of vacant land.

TABLE I

COEFFICIENTS OF CORRELATION AND DETERMINATION: POPULATION GROWTH IN THE URBANIZED AREA

Independent variables	*Coefficients of correlation* (r)	*Coefficients of determination* (r^2)
Amount of vacant land	0.35*	0.12
Accessibility of an outlying city	.01	.00
Cost of housing	− .08	.01
Birth-death differential	.36*	.13
Number of persons engaged in manuf.	.30	.09
Age of an outlying city	.09	.01
Density of the population	− .16	.02
Size of the population	.19	.04
Quality of the schools	0.11	0.01

*Significant at the 0.05 level.

TABLE II

COEFFICIENTS OF MULTIPLE CORRELATION AND MULTIPLE DETERMINATION

Areas	*Coefficients of multiple correlation* (R)	*Coefficients of multiple determination* (R^2)
Urbanized Area	0.60*	0.36
Northern Sector	0.90*	0.81
Western Sector	0.47	0.22
Southern Sector	0.78*	0.61

*Significant at the 0.05 level.

The multiple regression analyses were executed for the Urbanized Area as a whole and for each sector within it. This plan was followed because it provided information about the regional division of the Urbanized Area. The following paragraphs summarize the more important findings.

The simultaneous use of the nine independent variables "accounts for" approximately 36 per cent of the variation in population growth within the Urbanized Area (Table II). This is approximately three times the amount "explained" by the most closely related variable when only simple relationships were considered. It was felt, however, that an "explained" variation of only 36 per cent is not a large proportion.

Two facts explain the limited success of the multiple regression analysis. First, much "unexplained" variation occurs in one observation. Approximately 38 per cent of the "unexplained" variation in population growth is attributable to the extremely poor estimate for the Village of Oak Park. Second, only two independent variables, birth-death differential and density of population, show a significant relationship to population growth when all nine variables are controlled statistically (Table III). These relationships are summarized as follows:

1. Outlying cities with greater positive differences between births and deaths experienced, on the average, greater population growth from 1940 to 1950 than cities which had smaller positive differences.
2. Outlying cities with lower densities of population experienced, on the average, greater population growth from 1940 to 1950 than cities with higher densities.

The negative association between population growth and density of population is compatible with the positive relationship between population growth and the birth-death differential. The association between growth and the birth-death differential indicates the importance of natural increase to the population growth of outlying cities. This, in turn, suggests the movement of young married couples into outlying cities to raise families. Such persons desire single family residences and these dwellings are more closely associated with lower densities of population than are multiple dwellings. Thus, it appears logical that cities with larger population increases would be those with lower densities. This association is indicated by the statistical evidence.

This logical framework suggests an additional factor for investigation. The role of young married couples within

TABLE III

STANDARD PARTIAL REGRESSION COEFFICIENTS FOR THE URBANIZED AREA

Independent variables	*Value in standard form*
Amount of vacant land	−0.02914
Accessibility of an outlying city	−.15893
Cost of housing	−.02494
Birth-death differential	.40187*
Number of persons engaged in manufacturing	.03631
Age of an outlying city	.10300
Density of the population	−.73640*
Size of the population	.35312
Quality of the schools	0.20506

*Significant at the 0.05 level.

this rationale suggests that changes in the spatial distribution in the age or the marital status of the population in outlying cities may be a significant variable affecting the spatial distribution of population growth.

SIGNIFICANCE OF THE REGIONAL DIVISION

Certain differences in the results of the regression analyses suggest that the regional division of the Urbanized Area "explains" a significant amount of the spatial variation in population growth. For example, approximately 80 per cent of the variation in population growth is "explained" by nine variables in the Northern Sector as opposed to only 22 per cent in the Western. In the Southern Sector, approximately 60 per cent of the total variation is "explained." This evidence, however, does not involve a specific test of the regional differences under optimum conditions.

The significance of the regional division was tested specifically by comparing the multiple correlation coefficients for each sector with the multiple correlation coefficient for the Urbanized Area. Birth-death differential and density of the population are the independent variables employed because they were the only ones significantly associated with population growth according to the multiple regression analysis for the Urbanized Area. In addition, Oak Park, which contributed greatly to the "unexplained" variation in population growth, was excluded from the analysis.

The coefficient of multiple correlation is significantly greater in the Northern Sector than it is in the Urbanized Area; it is significantly smaller in the Western Sector than in the Urbanized Area (Table IV). In addition, the coefficient of multiple correlation is significantly greater in the Northern Sector than the same measure for the Western Sector. These differences indicate that the regional division is a factor "explaining" a significant amount of variation in population growth.

TABLE IV

SIGNIFICANCE OF THE REGIONAL DIVISION

Areas	*Difference between z values of multiple correlation coefficients in standard form*
Urbanized Area–Northern Sector	2.46*
Urbanized Area–Western Sector	2.30*
Urbanized Area–Southern Sector	.62
Northern Sector–Western Sector	2.76*
Northern Sector—Southern Sector	1.13
Southern Sector–Western Sector	1.78

*Significant at the 0.05 level.

RESIDUAL POPULATION GROWTH

Maps of residual population growth were prepared for each of the regression analyses in which there was a significant association between population growth and an independent variable. For the purpose of this study, residual population growth is defined as the difference between observed population growth and population growth as estimated in a given regression analysis. As they are employed in this investigation, maps of population growth residuals show the location of cities in which growth estimates concur closely or deviate widely from observed values. Such maps frequently yield information by suggesting for study other variables whose spatial patterns are similar to the pattern of the residuals or by suggesting modifications in present regional divisions by identifying specific areas where rather large residuals are concentrated.

Northern Sector

A clear pattern of residual growth appears within the Northern Sector

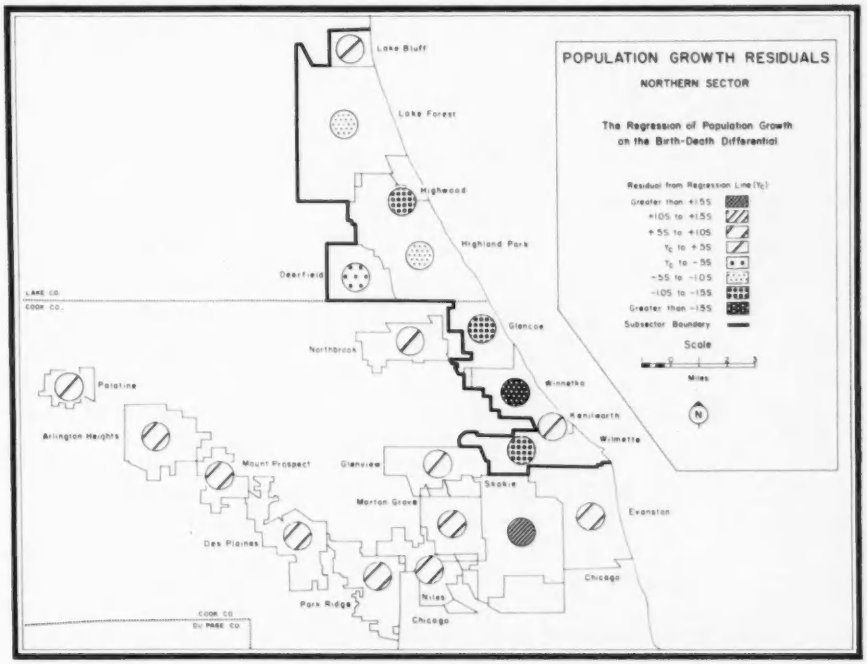

FIG. 5. Population growth residuals, Northern Sector.

based upon the distinction between the cities in which population growth is overestimated and those in which population growth is underestimated (Fig. 5). Population growth in the cities adjacent to Lake Michigan, north of Evanston, is regularly overestimated; population growth within the remaining cities of the sector is underestimated.

The municipalities adjacent to Lake Michigan are traditionally "prestige" cities. This fact, coupled with the distinction between those cities and others in the Northern Sector, suggests that some aspect of the economic character of the population, such as the median income of the residents of a city, may be significantly associated with population growth. If such a factor is significant in the Northern Sector it may prove to be important within the Urbanized Area as a whole.

Western Sector

The pattern of population growth residuals in the Western Sector shows two facts. First, population growth in the western and southern cities of the sector is generally overestimated (Fig. 6). Second, the cities in which population growth is underestimated are generally located in the eastern part of the sector, although population growth in all cities in the eastern part is not underestimated. The western and southern cities may be included in one residual growth region with population growth overestimation as the element of homogeneity.

The pattern of population growth residuals does not suggest additional variables for investigation, because it does not resemble the pattern of any pertinent phenomenon known to be dis-

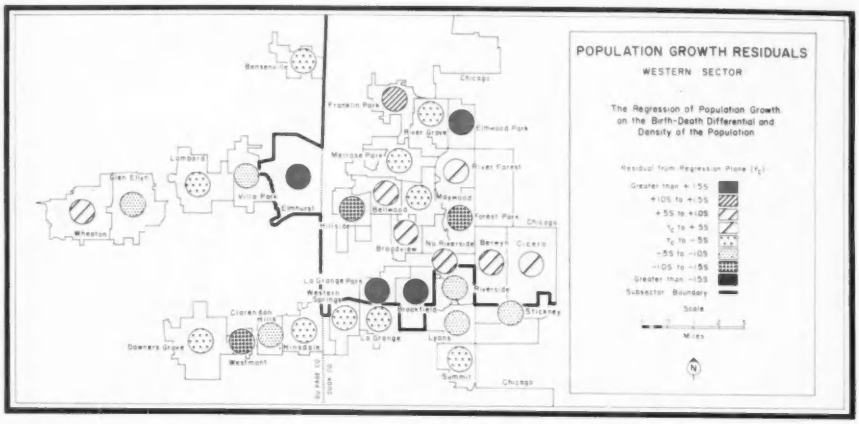

FIG. 6. Population growth residuals, Western Sector.

tributed within the cities. This condition is partially explained by the fact that these southern and western cities are very heterogeneous in character. It appears that subdividing the Western Sector may increase the precision of population growth estimates even though the pattern of residuals does not immediately suggest additional variables for investigation.

Southern Sector

The spatial pattern of population growth residuals within the Southern Sector shows two facts. First, population growth among Illinois cities south of Calumet City, Harvey, and Posen is generally overestimated (Fig. 7). Second, population growth in cities in Illinois north of Posen and in the cities of Indiana, except for East Chicago and Whiting, is frequently underestimated.

The municipalities of the Southern Sector in which population growth is underestimated are generally those located close to the larger municipalities. Commercial and industrial activities in Chicago, Hammond, and Gary may employ and serve significant numbers of persons from near-by cities. Hence, distance between cities in the Southern Sector and one of the major municipalities may "explain" a significant amount of areal variation in population growth.

Population growth residuals for East Chicago are particularly noteworthy; the magnitude of the residuals remains relatively constant and relatively large for all regression analyses (Fig. 8). It appears that the factors which affect the population growth of East Chicago are not included in the study. East Chicago, therefore, may be a particularly fertile place for field investigation which may lead to the formulation of additional general hypotheses.[16]

CONCLUSIONS

A conservative attitude toward the results of the regression analyses were maintained throughout the study. Now we may attempt a much broader interpretation in order to derive greater analytical and methodological value from the statistical results.

First, it is generally disquieting that

[16] The Village of Oak Park, which alone is responsible for almost 40 per cent of the "unexplained" variation from multiple regression also may provide additional hypotheses when investigated intensively.

the factors employed in this study "explain" such a small amount of areal variation and that so few of them are statistically significant. Each of the factors was hypothesized because of a logical, theoretical association with population growth. Although these independent variables do not expend the factors which could have been investigated, they appear to include many of the more apparent ones. If the areal associations between population growth and the factors actually associated with it are accepted as representative, then areal associations, in general, are at best poorly understood at present.

Second, again assuming that it is representative, the study indicated that in general, areal associations are very complex with many close interrelationships. This conclusion is based upon the relatively close associations which occur between some of the independent variables. Such complexity stresses the importance of analytical tools by which complex associations and interassociations may be separated quantitatively.

Third, the strong areal associations between independent variables suggest that it may be possible to isolate a comparatively small number of so-called "common" factors which are basic to the spatial pattern of a large number of other phenomena. For example, density of population is significantly associated with many of the independent variables and thus may be considered a kind of common or universal factor affecting spatial distributions within the Urbanized Area. On a more general level, the distribution of population may be a factor which exerts a significant effect upon the spatial pattern of many social and economic phenomena. The removal of common factors in the initial stages of analyses may expedite the

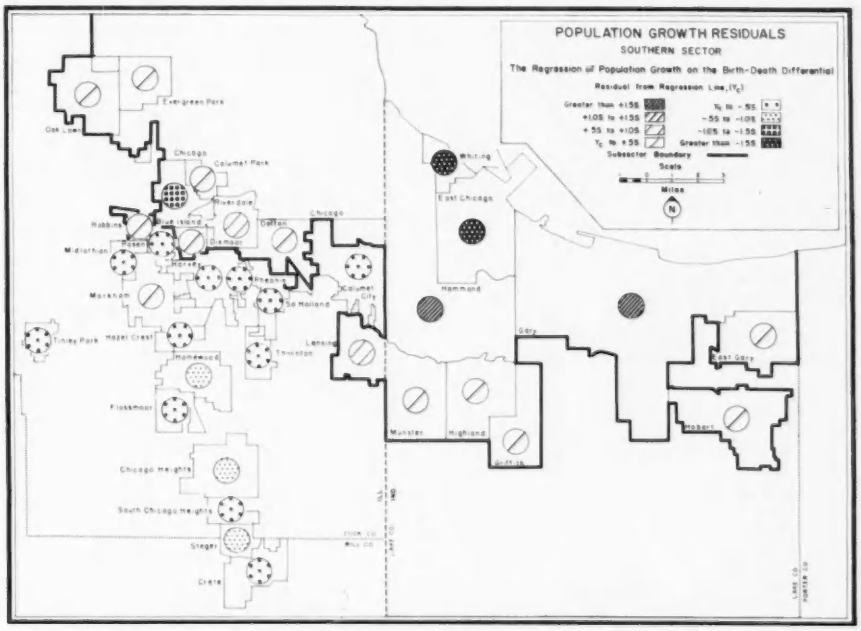

FIG. 7. Population growth residuals, Southern Sector.

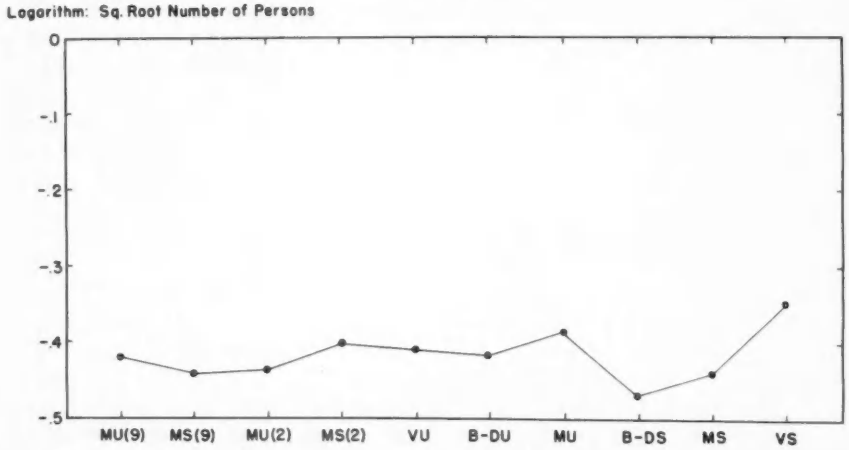

FIG. 8. Population growth residuals: East Chicago, Indiana. The following symbols appear on the graph: MU(9), multiple regression for the Urbanized Area employing nine independent variables; MS(9), multiple regression for the Southern Sector employing nine independent variables; MU(2), multiple regression for the Urbanized Area employing two independent variables; MS(2), multiple regression for the Southern Sector employing two independent variables; VU, the amount of vacant land for the Urbanized Area; B-DU, the birth-death differential for the Urbanized Area; MU, the number of persons engaged in manufacturing for the Urbanized Area; B-DS, the birth-death differential for the Southern Sector; MS, the number of persons engaged in manufacturing for the Southern Sector; VS, the amount of vacant land for the Southern Sector.

determination of specific factors germane to the particular problem.

This study was conceived and executed to test the acceptability of well-known hypotheses in the solution of specific problems in urban geography. Through the use of correlation-regression analysis it was possible to obtain precisely defined results that would be available for comparison with the findings of other studies. It is hoped that through similar investigations, undertaken for other places and for other times, a set of independent variables may be assembled which provide an adequate general "explanation" of the population growth occurring in outlying cities.

STONE WALL STRAWBERRY INDUSTRY ON KUNO MOUNTAIN, JAPAN

George H. Kakiuchi

Dr. Kakiuchi is an instructor in the Department of Geography, University of Washington. Much of the material for his present study was obtained while he was in Japan on a Fulbright Fellowship in 1953 and 1954.

THE Meiji Restoration (1868), which marked the historic beginnings of Japan's modernization, brought about many changes in the nation's economy. The effects of modernization on Japan's industrial economy are well known and were indeed spectacular, but no less important was the impact it had on the agricultural economy. The development of new industries and attendant rapid urbanization created increased and new demand for fresh vegetables, fruits, and specialized crops. The urban markets for these perishables became increasingly accessible as modern transportation, namely the railroad, spread outwards from the major cities.

The result was that cash cropping came to occupy an increasingly significant position in the farm economy, adding vitality and giving new hope to many Japanese farmers in their efforts to raise their living standard. Also, at the same time, many former sources of subsistence and income were being eliminated due to new forces generated by the Restoration and this forced many people to readjust to the changing times. It was under such conditions that the unique *ishigaki* or "stone wall" cultivation of out-of-season strawberry of Kuno came into being.

The Setting

The "stone wall" strawberry industry is located in a narrow belt[1] on the south side of Kuno Mountain in the southern part of Shizuoka Prefecture and faces the warm waters of Suruga Bay. It is approximately 110 miles southwest of Tokyo (Fig. 1).

Hemmed in by the steep truncated slope of Kuno Mountain[2] on the north and by the waters of Suruga Bay on the south, the nine hamlets (buraku)[3] comprising the narrow belt had been known for their poverty as much as they are known today for their relative prosperity.

Like so many other hamlets found along the narrow coastal beaches of Japan, the hamlets of Kuno are poorly endowed with arable land. The sandy and infertile soils had provided little opportunity to grow the traditional subsistence crops, namely rice. In fact the eight hamlets, excluding Higashi-

[1] The narrow belt extends for about four miles along the Bay and inland about 1200 to 1500 feet. Keiji Ninomiya "Kuno no ishigaki ichigo" (The "stone wall" cultivation of strawberry in Kuno), *Shizuoka-ken no engei*, Shizuoka City, Shizuoka-ken keizai-bu, 1952, p. 64.

[2] Kuno Mountain is like a flattened dome which is truncated on its south side. The truncated slope is quite steep due either to downfaulting or wave-cutting. The highest portion rises to about 1000 feet in elevation. The flattish top is of an old terrace surface. Glenn T. Trewartha: "A Geographic Study in Shizuoka Prefecture, Japan," *Annals of the Assn. of Amer. Geogrs.*, Vol. 18, 1928, p. 185.

[3] The hamlets from east to west are Zo, Hebizuka, Negoya, Ago, Furuyado, Aozawa, Naka-Hiramatsu, Nishi-Hiramatsu, and Higashi-Oya.

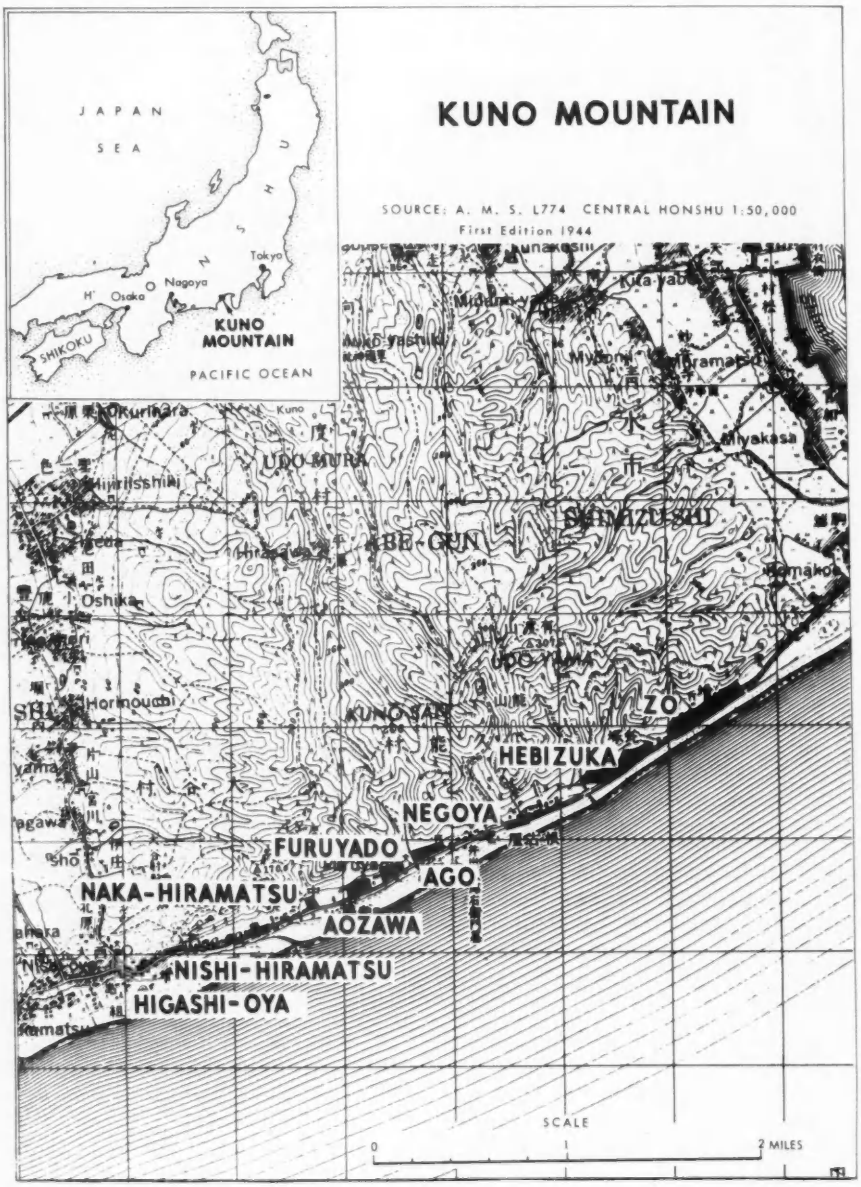

FIG. 1. Relief map of Kuno Mountain. The insert shows the location of Kuno and its principal markets.

Oya, had only a combined total of 3.9 acres of paddy land.[4] Consequently, the farmers have had to rely on some sort of cash crops or products for a livelihood. Since the turn of this century, the growing of out-of-season vegetables and other specialized crops for the large urban markets has become increasingly important. Of these crops, strawberries are especially important due to their particular adaptability to the slope land back of the hamlets; that is, the steep south slopes of Kuno Mountain.[5] For the rise of the off-season cash crop industry, there were certain environmental advantages. Of these advantages, probably the principal one was the local climate.

THE CLIMATE

The Kuno area, circumscribed by the south slope of Kuno and the waters of Suruga Bay, has been called a "natural" hothouse. Kuno Mountain which rises to about 1000 feet protects the south side from the cold winter winds, and the waters of Suruga Bay, warmed by the north-flowing Kuro-shio (Japan Current), give protection from the importation of low temperatures. Furthermore, the slope which faces the low winter sun and the sandy beach accumulate an unusual amount of solar heat. Being on the lee side of the mountains of Japan, the incidence of sunshiny day is high during the winter months.

Consequently, within the natural hothouse, the minimum winter temperatures are normally 5.4 to 14.4 degrees Fahrenheit warmer than the areas to the immediate west or east of the Kuno area (Fig. 2). The minimum temperatures rarely fall below 35.6 degrees.[6] Such a climatic condition, needless to say, was favorable for the introduction of out-of-season crops. However, important as the local environment was for the introduction of off-season cash crops, more important were the historical changes within Japan since the Meiji Restoration which directly or indirectly affected the economic base of the Kuno hamlets.

HISTORICAL DEVELOPMENTS

The nine hamlets of Kuno, as already stated, possessed little arable land on which to grow the traditional subsistence crops. Therefore, sources of cash income have been essential to maintain the livelihood of the villagers.

Up until about the turn of this century, the villagers had derived much of their meager income from the sea, largely from small-scale production of

[4] The total cultivated acreage of the eight hamlets in 1934, including the slope land converted to the cultivation of "stone wall" strawberry, was 326 acres. However, it is to be noted that because of the shortage of arable land, some of the farmers rented or owned farm land outside of the Kuno area. For example, some of the farmers of Zo and Hebizuka own and rent land in Komagoe which is located on the coastal plain just to the east of the two hamlets. Also, a few of the farmers of Negoya have dry field cropland on the top side of the Kuno terrace. Gohei Ito: "Shizuoka-ken Kuno-san nan-roku ni okeru soki saibai no ritchi ni kansuru kenkyu" (A study concerning the location of the early strawberry cultivation on the southern foot of Kuno Mountain in the prefecture of Shizuoka), *Otsuka chiri gakkai ronbun-shu*, Tokyo, Kokin Shoin, Vol. 4, 1934, pp. 193–211.

[5] The degree of importance of the strawberry crop varies according to the amount of level land available to the individual hamlets. For the very narrowly restricted hamlets of Zo and Hebizuka, where the mountain pinches out the beach, 90 to 95 per cent of the farmers in 1934 were engaged primarily in the cultivation of "stone wall" strawberries. This percentage dropped towards the west as the beach widens out. Thus in the middle portion (Negoya, Ago, Furuyado, and Aozawa) about 50 to 60 per cent of the farmers were primarily engaged in the growing of strawberries. Finally in the three western hamlets, the percentage decreased to 20 to 40 per cent. *Ibid.*, p. 194.

[6] Norin-sho tokei chosa-bu: "Ishi-gaki ichigo saibai chitai jitsuno chosa oyobi ichigo saibai jitsuno chosa" (Survey of the actual conditions of the "stone wall" cultivation area and the actual strawberry cultivation), Norin tokei kyokai, Tokyo, 1949, p. 2.

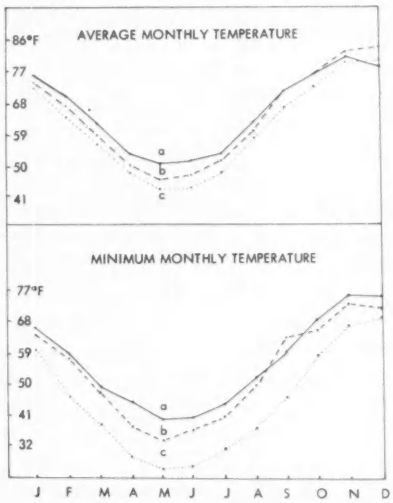

FIG. 2. Comparison of temperatures. Letters refer as follows: (a) Kuno Village; (b) the Agricultural Experiment Station, Shizuoka Prefecture; (c) Okitsu Agricultural Experiment Station. Source: *Otsuka chiri gakkai ronbun-shu*, Tokyo, Kokin Shoin, Vol. 4, 1934. The Okitsu station is located to the northeast of Kuno and the other is located to the west.

salt and to a lesser degree from the production of sugar and local fishing.[7] Also some cash crops were grown, such as vegetables, tea, and loquats, but these constituted only a small part of their income. These latter products were sold in near-by cities of Shizuoka and Shimizu by the women folks who took them to the markets in "rear-carts" and baskets.[8]

With Japan's modernization, however, the above principal sources of income were to be eliminated. The first to be eliminated was the making of sugar. This occurred with the removal of the protective tariff and the consequent importation of cheap sugar from Formosa. Following this, in 1905, the salt-making industry became a government monopoly. This was a serious blow to the local economy, for the production of salt had been the most stable and important source of income.[9] Lastly, the small-scale fishing gradually declined with the coming of larger motorized fishing boats and organized companies which operated out of ports with facilities to handle their needs. By 1925, there was little or no fishing for commercial purposes in the Kuno hamlets.

Thus during the first part of this century, where heretofore the sea had provided the main sources of income, now by necessity the villagers had to turn to their meager land resources. The former "sea" men were now to become "land" men. However, having practically no paddy land, their future prospects indeed looked bleak.

Fortunately, the crisis came at a time when the growing urban centers were creating demands for a variety of agricultural products. The farmers of Kuno, limited as they were in economic resources, were to adjust to the new situation by utilizing the few advantages they possessed—a natural hothouse, a good location in respect to markets, and a tradition for hard work and frugality—to go into the cultivation of out-of-season vegetables and other specialized crops.

The first out-of-season crops to be introduced were vegetables such as cucumber, tomato, and eggplants, which were mainly grown in glass-topped frame hotbeds. But limits to expansion were set by the very narrow beach, for these

[7] In most of the hamlets, over 50 per cent of the villagers derived their livelihood principally from the sea. In Negoya, the percentage was 80 per cent. Ito, *op. cit.*, p. 198.

[8] The division of labor was that the men went to sea, while the women worked on the land—farming and in the making of salt and sugar. The making of salt was especially arduous, and the women of Kuno are even today known for their hard-working qualities.

[9] The government consolidated the salt industry along the shores of the Inland Sea, where the climate was better suited to the production of salt by the standard solar method. Norin-sho tokei chosa-bu, *op. cit.*, p. 1.

frames and the crops could not be readily adapted to the steeper slopes back of the hamlets. Consequently, this initial endeavor was hardly the answer for the majority of the farmers, especially for those in the eastern hamlets, such as Zo and Hebizuka, where the width of the beach was extremely limited. However, for the Kuno area in general, the growing of early vegetables did constitute the principal source of income until about the end of World War I.

As far as it can be determined, the first strawberries were planted in the Kuno area, as an experiment, in Zo around 1905 by a Mr. Seisaku Ogiwara.[10] The strawberries were taken to near-by markets but met with little success due largely to consumer resistance to this unfamiliar product. Many thought that they were poisonous. However, Mr. Ogiwara had heard that they commanded excellent prices in the more westernized city of Tokyo and so persisted in his efforts to acquaint and sell them in the near-by cities, namely in Shizuoka.

In 1908, it is recorded that the same Ogiwara discovered, purely by accident, that strawberries growing among the smooth water-worn stones not only produced excellent berries but ripened earlier. Being enterprising and experienced in the marketing of early vegetables, he realized the eventual potential of this chance discovery. From this beginning he developed the present "stone wall" cultivation of off-season strawberry. Although the initial discovery was by accident, the development and expansion of this new source of income occurred through innovations, scientific cultivation, frugality, active selling, and a tremendous input of labor.

[10] There are several versions as to when and who first grew strawberries, but in one way or another, Ogiwara seemed to have had a hand in it during the early period.

The principal innovation which made possible the expansion of the cultivation of "stone wall" strawberry, and more important the expansion in the total cultivated acreage for the nine hamlets, was the creation of the triangular ridges (Fig. 3). The prime importance of the ridging technique was that the hitherto little used Kuno slope could now be brought under intensive cultivation to excellent advantage.[11]

It was the two hard-pressed eastern hamlets of Zo and Hebizuka, under the pioneership and enthusiasm of Ogiwara, that took the lead in the cultivation of "stone wall" strawberry. The crop was now shipped to the markets of metropolitan Tokyo, where the off-season strawberries were well received and commanded excellent prices.[12] As the demand for these strawberries increased and the new endeavor became firmly established and successful, the neighboring hamlets to the west began to follow suit. The more accessible lower slopes were the first to be ridged, but as the industry expanded the triangular ridges began to encroach upon the steeper and higher slope area.

Although the acreage of "stone wall" strawberry expanded relatively rapidly in Zo and Hebizuka, the overall expansion in respect to the Kuno area was rather slow until after 1923.[13] There were several tangible reasons for the relative slowness. First, there was the necessity of annually rebuilding the stone faces of the ridges which was time-consuming and difficult.[14] Second, the

[11] The need for bringing more land under cultivation can be realized when it is seen that even as late as 1934 the average cultivated acreage per farm was only 0.6 except in the westernmost hamlet of Higashi-Oya. Ito, *op. cit.*, p. 199.

[12] The varieties shipped were Excelsior and Victoria.

[13] Norin-sho tokei chosa-bu, *op. cit.*, p. 2.

[14] The stone faces were rebuilt annually at the time of planting to refertilize the soils in the

(*Continued on next page*)

stones necessary for the construction of the ridges were becoming scarce. Third, and perhaps the most serious handicap was that, as the man-made ridges reached further up the slope, the problem of irrigation became increasingly difficult. Irrigation is absolutely essential in Kuno, for the winter months are relatively dry and warm. Although the farmers stored whatever rain and spring water that could be channeled into the tanks located above the cultivated area, much of the water had to be carried up to the tanks in buckets. Therefore, during the season, a large percentage of the labor available had to be expended in this operation and for the irrigation of the plants themselves.

However, in the immediate years after 1923, two new innovations greatly contributed to the further and more rapid expansion in acreage. In 1924, power-driven pumps were installed. This not only eliminated the laborious bucket brigade, but more important it meant that water could now be readily transferred to any point in the slope area. Then, in the following year, specially-molded and standardized concrete blocks were invented to replace the former, awkward stones. These standardized blocks were much easier to handle, eliminating the drawbacks which were associated with the uneven round stones. Furthermore, they could be easily and cheaply made as needed by the farmers from the sand and gravel of the beach area. These two new developments meant increased efficiency in operation. The labor saved was transferred to increasing the acreage of

interstices into which the strawberry plants are inserted. There was also a tendency for the rains to wash out the soils and the walls would disintegrate. The whole process was rather inefficient. A picture of the old type of triangular ridges, using stones to build the face, can be seen in Trewartha, *op. cit.*, p. 195.

FIG. 3. Triangular ridges on the south facing slopes of Kuno Mountain. The strawberry beds are built at an angle of 60 to 65 degrees to receive the low winter sun at 90 degrees.

"stone wall" strawberry. Thus from a total acreage of 14.4 acres in 1923, it increased to 72 acres in 1930, finally reaching the pre-war peak acreage of 144 acres in 1939.[15] In fact, the lower half of the south slope of Kuno Mountain was rebuilt into a veritable "stone" or more correctly concrete wall (Fig. 3). The only limits now were the steepness of the upper slopes[16] and the extent of the urban markets.

The installation of pumps, making of concrete blocks, and expansion in acreage all required capital, however small, which is the one thing the average Japanese farmer finds difficult to accumulate. But, fortunately for the farmers of Kuno, good prices were being paid for their produce during the few years prior to and after 1924. And coupled with hard work, frugality, and cooperation they were able to accumulate and invest in the new innovations and expansion. Often two, three, or more families pooled their resources to buy such larger equipment as power pumps.

For the hamlet of Zo, there seemed to have been another perhaps more important source of capital. During the early 1900's, 15 or 16 young men left the hamlet to work in the coal fields of Mexico, eventually moving northward into Colorado to work on the vegetable farms. It is said that these former farmers of Zo sent or brought back money with them during the period from 1925 to 1935, exactly during the time when rapid expansion in "stone wall" strawberry acreage was observed.[17] It would seem that 15 or 16 men from a hamlet of 40 households could have had considerable effect on the economy of the hamlet itself.[18] It can be presumed that the other hamlets of Kuno also had sent their young men abroad to work during the early part of this century. Through a combination of favorable factors then, the "stone wall" strawberry industry saw its greatest expansion during the period from 1924 to 1939. After the peak year of 1939, the strawberry industry entered into a period of decline as Japan increasingly began to gear herself to a war economy. Farm supplies, especially the all-important fertilizers, became difficult to obtain. Also, as milk and particularly sugar became scarcer, the consumers stopped buying strawberries which were considered too sour to eat by themselves. As a result the acreage of strawberries in Kuno gradually decreased. Finally, with the onset of World War II, the industry was completely eliminated by the government, which considered the growing of out-of-season strawberry non-essential to the war effort.

With the end of World War II, a period of recovery began. The recovery was relatively slow, largely due to the continued shortage and high cost of farm supplies and disruption of the national economy. However, by 1951, the acreage of "stone wall" strawberry was 65 per cent of the pre-war peak of 1939,[19] and full recovery was attained in 1958.[20]

CULTIVATION

The cultivation of "stone wall" strawberry was developed in the Kuno area and has remained, even until today, unique to that area.[21] One of the

[15] Norin-sho tokei chosa-bu, *op. cit.*, p. 3.

[16] The physical limits of expansion is reached when the slope attains an angle of 60 degrees.

[17] Norin-sho tokei chosa-bu, *op. cit.*, p. 6.

[18] One often comes upon a village or hamlet in southwestern Japan which looks more prosperous than the local economy would seem to justify. Many times it has been the result of money sent or brought back by people who had emigrated to the Americas.

[19] Ninomiya, *op. cit.*, p. 64.

[20] Letter from the Economics Bureau, Shizuoka Prefectural Government, April 10, 1958.

[21] Although the growing of out-of-season strawberry by the "stone wall" method is unique to

(*Continued on next page*)

principal factors in this localization, according to some people, is that the growing of strawberry by the ridging method requires a good deal of experience and a high degree of skill—one that farmers in other areas, with similar physical environment, have not been able to emulate.[22] Also historically, it seems that once a crop or product becomes associated in the consumer's mind with a certain locality or name, it becomes difficult for new areas to break into the market, especially if the crop or product is of a specialized nature.

Within the Kuno area, the cultivation of "stone wall" strawberry has been largely restricted to the slope area to which the triangular ridges were adapted.

In the efforts of the farmers to bring the area on the south side of Kuno Mountain under cultivation, five land-use zones can be identified. The five zones extend from the summit to the sea. Zone "A" (60–80 degree slope) is near the summit and is entirely forested in pine and shrubs. This zone is too steep to bring under cultivation and has been left in forest to protect the lower levels from rolling rocks. Zone "B" (30–60 degrees) was formerly forested and had been used as a source of wood for the making of charcoal and gathering of firewood for the boiling of salt and sugar. Today, it is used entirely for the growing of strawberry. Zone "C" (10–30 degrees) had been used for the growing of loquats but is now in strawberry. Zone "D" (3–10 degrees) has been and is still intensively utilized to grow a variety of crops. During the winter such crops as cucumber, sugar pea, and flowers are grown in frame hotbeds in addition to strawberry. Summer crops consist of daikon (a Japanese radish), sweet potato, burdock, taro, white potato, cucumber, and strawberry seedlings. The hamlets are located in this zone in a linear fashion along the road. Zone "E" (0–3 degrees) is the beach area, lying between the road and the sea. Formerly it had been used for the beaching of the small fishing boats and for the solar production of salt. Today the land utilization of Zone "E" is similar to that of Zone "D." However, in Zo and Hebizuka, where specialization in the growing of "stone wall" strawberry has been carried the furthest, 80 per cent of the beach area is now used for this one crop.[23]

Although there are a number of unique techniques involved in the cultivation of "stone wall" strawberry, one of the most conspicuous is the ridging of the beds upon which the plants are grown. The side and back walls of the triangular ridges are permanent, but the front south-facing side is rebuilt annually either prior to or at the time of planting. Originally, round stones were used to face the south side but today, as mentioned before, concrete blocks have replaced them. Each block has three "V" shaped niches cut out along the top edge wherein the plants are inserted.[24] The blocks are arranged in rows, one atop the other, after a handful of well-fertilized soil has been placed within.[25]

the Kuno area, there are other techniques found here and elsewhere. The two most common ones are the utilization of frame hotbeds and the *hina-dan*. The latter method utilizes step-like beds, whose retaining walls are built of 3 inch high boards held in place by bamboo stakes. The width of the horizontal bed surface varies according to the angle of the ground. In contrast to the "stone wall" technique, glass or plastic covering are used to create an artificial hothouse condition. Ninomiya, *op. cit.*, p. 66.

[22] A village on Muko Island in the Inland Sea tried but was unsuccessful. The reason given was that the farmers of Kuno would not teach them the techniques.

[23] Ito, *op. cit.*, p. 197.

[24] Each block measures 1′ 5″ x 6″ x 1″. Ninomiya, *op. cit.*, p. 66.

[25] The soils of Kuno are extremely infertile

(*Continued on next page*)

The creation of the triangular ridges enabled the farmers to make intensive use of the slope area, but the basic purpose of the structure itself has been to take full advantage of the low winter and early spring sun. The south face of the ridges is slanted at an angle of 60–65 degrees, so that the concrete blocks will receive the sun's rays at an angle of 90 degrees, thus maximizing insolation. Furthermore, charcoal has been mixed into the concrete to further increase the absorption of solar heat. The blocks serve the dual purpose of receiving and maintaining heat and of holding the soils within the walls. During the latter part of the season, after the roots have set and foliage well-developed, the blocks may be removed to prevent the strawberries from ripening too fast.[26]

In the actual cultivation of the strawberries, probably the single most important factor in determining whether the farmer gets a good crop of quality strawberry or not is the proper application of water to the plants.[27] If too much water is applied, excessive leaf and stem growth occurs and there is danger of fungus diseases. If too little water is applied, the plants are weakened and also become susceptible to red mite infestations.[28]

As mentioned previously, the application of water demands a great deal of labor input. It is estimated that even with the installation of the power pumps, irrigation still requires 50–82 per cent of the total amount of labor needed for cultivation.[29] Most of this labor is provided by the women and children of the nine hamlets.

The planting of the two earlier varieties of strawberries—Excelsior and Fukuha—is begun in the latter part of September, while the later Victoria is planted during the first part of October. Originally, the very involved process of planting was all done at one time. Each concrete block was removed, a handful of fertilized soil placed behind each triangular niche, the blocks replaced, and finally the plants were set in. This procedure necessitated a concentration of labor into a very short and busy period. However, in 1935, another innovation enabled the farmers to utilize their labor more efficiently. This was to prepare the beds for the plants somewhat prior to the actual time of planting, thereby giving the farmers a better distribution of their available labor.[30]

Once the plants are set in, additional but simple measures are taken to protect the plants and to prevent the loss of heat during the nights of the colder months, generally from November through February. Board or the more common reed or straw mats are used as coverings over the strawberry beds (Fig. 5). During the coldest months, January and February, two sets of mats may be used. No plastic or glass coverings are necessary as is the case in other cooler areas growing off-season strawberry.

and require heavy fertilization. For every 1000 plants (30,000 plants to 0.245 acre) 240–320 pounds of manure, 32–40 pounds of seed wastes, 56–64 pounds of fish wastes, 16 pounds of superphosphate, and a little potassium sulphate are used. In contrast to this ordinary field strawberries require only 40 pounds of nitrate, 24–40 pounds of superphosphate, and 32 pounds of potassium sulphate per 0.245 acre. *Ibid.*, p. 66.

[26] Ito, *op. cit.*, p. 205.

[27] The water is applied by hand, using a hose and a spray nozzle (Fig. 4). Water is brought down from the tanks to the ridged beds by means of pipes.

[28] Ninomiya, *op. cit.*, p. 66.

[29] Several waterings per day are necessary when the plants are first placed in their beds. This is reduced to twice daily once the roots become firmly established. During the period of pollination, the application of water is held to a minimum. Then it is increased once again when the strawberries become set.

[30] Under the old method, it was estimated that one worker could plant 500–700 plants a day. Under the new innovation, a worker could set in upwards of 1000 plants per day. Ninomiya, *op. cit.*, p. 66.

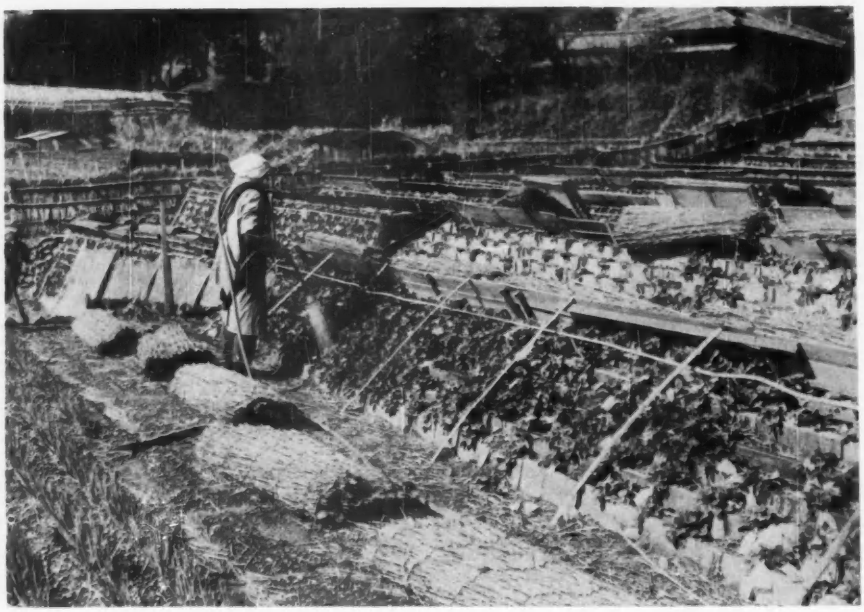

FIG. 4. Woman watering the strawberry plants.

Prior to World War II, three principal varieties of strawberries were grown in the Kuno area—Excelsior, Victoria, and Fukuha. The first two were of foreign origin, as the name would indicate, but the Fukuha was developed in Japan. It was introduced into the Kuno area in 1937. The Fukuha had been grown elsewhere under hothouse conditions, but it had been presumed that it could not be successfully grown on the "stone wall" ridges. However, upon experimentation, it was discovered that the Fukuha grew and produced very well. Furthermore, the quality was far superior to that of the other two. Consequently, the Fukuha was an immediate success, and its acreage expanded rapidly at the expense of the acreage devoted to Excelsior and Victoria. Within two years, the Fukuha occupied 60 per cent of the total acreage of strawberry in the nine villages.

In the post World War II recovery period, the Fukuha continued to dominate the acreage. In 1950, it occupied 50 per cent of the total acreage. Even though the Excelsior came out the earliest, because of its poor quality the percentage in Excelsior had dropped drastically to 5 per cent, while Victoria had increased its acreage to 45 per cent.[31]

The Fukuha seemed to have the best market potential, and so both the farmers and the prefectural agricultural experimental stations continued their efforts to improve the techniques for its cultivation, largely in terms of marketing quality strawberries early as possible. The efforts were successful, and today the Fukuha occupies 90 per cent of the total strawberry acreage of Kuno. The other 10 per cent is in Zasan and Shikisei, both of which are very early varieties newly developed.[32] The Excelsior and Victoria have, for all practical

[31] Norin-sho tokei chosa-bu, *op. cit.*, p. 4.
[32] Economics Bureau, *op. cit.*

purposes, been completely eliminated.

The overwhelming predominance of the Fukuha largely resulted from an innovation in the technique for the raising of the nursery plants. Formerly, practically all of the young plants were grown in the lowland paddies of Shida-gun located to the west of Kuno Mountain. Today, the plants are mainly grown on farms situated at an elevation of 2400 feet on the flanks of Mt. Fuji, which is located in the northern part of Shizuoka Prefecture. Here the fall weather comes earlier and results in quicker dormancy of the young plants. When the plants are brought down and set in the warm south face of the triangular ridges they soon begin their growth. As a result, the Fukuha can now be marketed in late November rather than in late December.[33] Thus the farmers through innovation have come to specialize in this one variety, attaining both quality and a earlier marketing season. Presumably, they could also stagger the length of the season by selecting the sites for raising the nursery plants in terms of elevation.

Several techniques have also been developed for the marketing of quality strawberries, especially in respect to the Fukuha which has been consistently the best seller.

After the plants are set in their beds and begin their growth, the new runners and buds are trimmed off, and except for five or six the remaining leaves are thinned out. The purpose of all this is to provide better air circulation, to allow more sunshine to penetrate and to give maximum nutrition to the strawberries. Not only is the plant trimmed but the berries are also thinned out. For the Fukuha variety, one plant is made to produce no more than 10 strawberries during the season.[34] Furthermore, each individual strawberry is covered with a paraffin-coated paper bag to protect it from diseases and insects and to enhance the color and luster (Fig. 6).

FIG. 5. Mat coverings used to protect strawberry plants during the evenings of the colder months.

The discussion on the various aspects involved in the cultivation of the "stone wall" strawberry points to one obvious fact—it requires a tremendous amount of labor. But labor in Japan is plentiful and cheap. Such a condition is especially suited for the growing of "stone wall" strawberry, which is highly demanding in labor but relatively little of capital. This characteristic is not only associated with farming in the Kuno area, but is generally true for Japanese agriculture as a whole. The pressure of a large agricultural population on a limited amount of arable land has given rise to small but intensively cultivated farms (average farm size is two acres).

Even though labor is cheap, much of

[33] *Ibid.*

[34] Three crops per season are harvested. For the first crop only four strawberries are left on the plant and three each for the second and third crop. For the other varieties, only the poorer berries are thinned out, and each plant produces 20 to 30 strawberries per season. Ninomiya, *op. cit.*, p. 67.

[35] It is estimated that one person can take care of 10,000 strawberry plants. Norin-sho tokei chosa-bu, *op. cit.*, pp. 14–15.

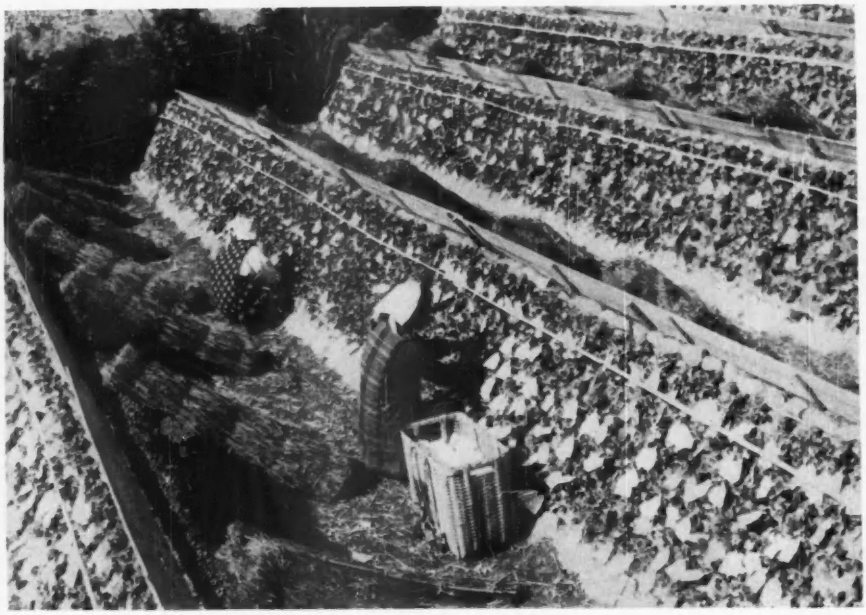

FIG. 6. Women covering strawberries with paraffined paper bags.

the labor needed on the individual farms of Kuno is provided by the members of the family, except during the busy harvest season.[35] The shallow economy of Japan does not allow for the luxury of hiring workers unless absolutely necessary. A few of the larger strawberry growers, however, do hire permanent year-round workers who are usually recruited from the poorer families of the local hamlets. The seasonal laborers come principally from the local area, but some may come from the near-by mountainous prefectures of Yamanashi and Nagano where the farm families have little to do during the winter months.[36]

HARVEST AND MARKETING

The success of the "stone wall" cultivation of out-of-season strawberry in the Kuno area has been the result of many interlocking factors, such as a favorable physical environment, development of innovations, and the efforts of the farmers. However, another and perhaps more important factor which must be considered is the location of Kuno between the two largest urbanized regions of Japan, namely the Tokyo-Yokohama and the Osaka-Kobe-Kyoto conurbations. The markets of the former are readily accessible, and the markets of the latter are no more than an overnight's distance away by rail.[37] Nearness to large urban markets is desirable to provide a measure of stability to such a luxury product as off-season strawberry, and a safe and rapid transport is essential, for strawberries are easily injured and spoil relatively quickly. These two requirements are

[35] In 1950, the permanent workers were paid about $28 (10,000 yen) per year plus room and board. The seasonal laborers were paid about 40–55 cents (150–200 yen) per day plus one meal. *Ibid.*, p. 15.

[37] Tokyo is about 110 miles and Osaka about 230 miles by rail from Kuno.

met by the location of the Kuno area.

The Tokyo-Yokohama and the Osaka-Kobe-Kyoto urban areas normally take 90 per cent of the strawberry production of Kuno. Of the two market regions, the larger and closer Tokyo-Yokohama conurbation is overwhelmingly the more important, taking about 77 per cent of the Kuno strawberry crop, while the Osaka-Kobe-Kyoto markets account for another 13 per cent.[38] The remaining 10 per cent is marketed to other fairly large cities such as Nagoya.

The strawberry season of Kuno generally extends from the latter part of November to April at which time the ordinary strawberry season begins. Up until recently, Excelsior was the first variety to be marketed, coming out during the latter part of November. Due to its early appearance, it had sold rather well, even though it did not begin to compare in quality with the Fukuha. The Excelsior was followed by the Fukuha which reached the markets during the latter part of December. The size of the berry is large and the quality unexcelled. For these reasons and because of its relative earliness, the Fukuha has been and has continued to be the best seller, usually bringing twice the price of the other two. Victoria came out around the middle of February and reached its peak in April. The peak period for this last variety coincides with the beginning of the normal strawberry season, and so the price drops precipitously.[39]

Today, as mentioned earlier, Excelsior and Victoria have completely dropped out of the picture. For all practical purposes, the Fukuha is the only variety grown on the south slopes of Kuno. The demand and prices seem to have encouraged the farmers to a high degree of specialization in this one variety, even though the Fukuha is much more difficult to grow and requires more labor and costs.

[38] Ito, *op. cit.*, p. 209.

[39] The average price paid in 1951 for a box of Fukuha during the early part of the season (late December) was about 50 cents (200 yen). This dropped to about 28 to 42 cents (100–150 yen) during the middle part of January, and then fell to about 28 cents (100 yen) after that. Ninomiya, *op. cit.*, p. 68. Each box contains 12–24 strawberries, depending upon the size.

CONCLUSION

The success of the Kuno farmers in the cultivation and marketing of out-of-season *ishigaki* or "stone wall" strawberry has been such that the nine hamlets along the south slope of Kuno Mountain have become known for their relative prosperity. But yet, these hamlets can be said to be well-off only when compared to their past when the villagers were mainly poor fisher-farmers. The average Kuno farmer has by no means become rich. Prior to World War II, many of the smaller growers had been chronically in debt. The fact that they have done as well as they have is certainly a credit to their ability to adjust to changing times, to work and persevere, and to continually innovate and improve.

Most of the farmers of Japan, with their small acreages, grow rice for subsistence on their best lands and cash crops on their poorer lands, which are marginal in respect to rice cropping. They try to maintain a delicate but important balance between subsistence and commercial farming in their efforts to achieve a degree of stability. But for most of the Kuno farmers, restricted as they are to the narrow beach and the steep south slopes of Kuno Mountain, there existed only marginal lands. Furthermore, the average size of a farm in the Kuno area is less than half that of the nation.

It was the accidental discovery of the possibility of cultivation of "stone wall" strawberry that energized the hamlets

to renewed vitality and relative prosperity. The farmers turned seeming adversities into advantages and capitalized and enhanced any assets they possessed.

Today, the cultivation of "stone wall" strawberry has become the principal source of income for the majority of the farmers of Kuno, occupying close to half the total cultivated acreage. Although the post-war recovery was slow, the pre-war peak acreage of 1939 has been reached. Expansion of the ridged beds up the slope appears to have reached its limit due to steepness, but further expansion seems now to be taking place onto the beach area on land which had been devoted to the growing of vegetables.

The amazing sight of the "stone wall" or rather concrete "wall" climbing half way up the steep south slope of Kuno is a standing monument to the achievement of the farmers of Kuno.

BOOK REVIEWS

Coal and Steel in Western Europe: The Influence of Resources and Techniques on Production, by NORMAN J. G. POUNDS and WILLIAM N. PARKER. 381 pp.; maps, tables, index. Indiana University Press, Bloomington, 1957. $6.00. 8¾ x 5¾ inches.

The economic-geographic literature on the coal and steel industries of Europe includes many studies of regional or national scope. Among these Professor Pounds' earlier book on the Ruhr and his more recent one on Upper Silesia hold an important place. In this volume, however, Professors Pounds and Parker combine their talents and special interests to examine more than two centuries of industrial history in an extremely complicated and diverse geographic area. Their theme is the "historical setting, within which recent rises in production and current problems and prospects of the European Coal and Steel Community must be viewed." But they hold their inquiry to manageable proportions by dealing mainly with questions of materials, technology, and corporate structure as these relate to the development and location of the coal and steel industries in France, Belgium-Luxembourg, and Germany.

About two-thirds of the book is the work of Professor Pounds in which, as those familiar with his research might expect, he presents the historical geography of these industries. The first of three chapters on the eighteenth century comprises an excellent description and analysis of the locational requirements and pattern of the charcoal-iron industry, supported by diligent research and discriminating selection of material including quantitative data, from original sources and contemporary commentaries. The third comprises a similar but brief review of the eighteenth-century coal industry and producing areas on the continent. Well placed between the two is a separate chapter on technology which deals in considerable detail with the locational and economic aspects of charcoal-iron technology, and then traces the British innovations in the use of coal and coke which established British leadership in the industry and the emergence of coal fields as its dominant location.

A second illuminating chapter on technology introduces the discussion of the nineteenth century in Part II of the book. At the beginning of this period the iron industry on the Continent was still predominantly charcoal-based and Professor Pounds traces the slow and halting efforts of the iron masters from Silesia to France to adapt their smelting and refining methods to the coke and coal techniques of their British competitors. He then moves on to a discussion of the better-known and revolutionary inventions of steel making which were the basis for the rapid expansion of the industry after 1860 and its emerging locational pattern. The transition from a charcoal iron to a modern steel industry was thus telescoped into a period of less than a century, and it would be hard to find a sounder and more lucid analysis of these technological changes.

This discussion provides excellent background for the more detailed examination of the nineteenth century developments in the various producing areas: the rise of Belgium to a position of leadership by the mid-nineteenth century and its subsequent eclipse; the changing locational phases in France from charcoal and water power to coal, to the short-lived period of coastal plants, and then to the final emergence of the eastern ore fields as the major locational attraction; the complexities of the Lorraine, Saar-Luxembourg area with the interactions of technology, raw material supplies, and national and corporate policies; and, finally, in Germany the development of Silesia under the stimulus of Prussian state officials and the ultimate dominance of the Ruhr among the longer-established producing areas of the west.

By the end of the nineteenth century the major locational pattern and raw material sources had become relatively fixed and the revolutionary innovations in steel making had taken place. Consequently, in the discussion of the twentieth century, Professor Parker lays greater stress on the analysis of general and regional rates of growth as well as a consideration of the influence of the cartels, especially as it bears upon the problems and the prospects of the Coal and Steel Community. Here also careful attention is given to the diffusion of technological information with particular attention to the improvements in coke production and the increase in scale of operations as they affected the relative advantages of different types of location. Of particular interest to geographers is his chapter on "the maintenance of an interregional balance" as between the various producing areas in which a careful distinction is drawn between those in the northern area (chiefly the Ruhr and coal field locations to the west) and the southern areas centered on Lorraine ore and the coal fields to the east.

Two main conclusions emerge. Firstly, that "the shares of the different regions in the Western European output of coal, coke, iron and steel have remained stable," although minor exceptions are noted and analyzed. Secondly, that the economic separation between the Ruhr and Lorraine, previously noted in Pounds' discussion of the earlier period, has increased, thus further qualifying the outmoded concept of a Lille-Dortmund-Nancy "industrial triangle" in which "Ruhr coal and Lorraine ore are 'natural complements' of one another." In view of this locational stability, which neither the cartels nor national policies nor economic fluctuations were able to alter in significant fashion, Professor Parker concludes that the Coal and Steel Community is unlikely to drastically alter the industry's geographic pattern. Its importance is as an instrument assisting in the orderly and steady increase in capacity and its success will depend "less upon what it can accomplish than upon what it can inspire."

This is indeed an important and timely addition to the book shelf of the economist and historian as well as that of the geographer. The teacher will dip into it frequently for both factual and interpretative materials. The researcher will find it useful as a guide both to source materials and to promising lines of inquiry.

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Dynamic Decade, by ERIC J. HANSON. xi and 314 pp.; maps, bibliogr., index. McClelland & Stewart, Lts., Toronto. (Distributed in U. S. A. by Dodd Mead & Company), 1958. $6.00. 9 x 6 inches.

In 1915 the population of Alberta was 480,000. It was not until 1946 that it had increased by 320,000, and yet by 1956 it had increased by as many again. What caused the increase in population in the decade 1946–1956 to be as great as that which it had taken 31 years to achieve before 1946? According to Professor Hanson, "practically all of this increase can be attributed to the oil development," and he sets out in this book to give an account of how this came about and how the provincial economy changed as a result. He then estimates the importance of the petroleum industry in the Alberta economy, now and in the future. Indeed, the subtitle of the book is "The Evolution and Effects of the Oil Industry in Alberta." That this is only a subtitle is deliberate, for this is not a textbook. The author has kept the technical discussions of the petroleum industry and the methodology of income analysis to a minimum, in order to appeal to the interests of the general reader, as well as the specialist. He has also achieved this aim through the judicious use of excellent black-and-white diagrams and sketch maps. Perhaps these betray the geographical influences which were at work over the author's shoulder, for he was guided and assisted by Dr. Herman Otte, Professor of Economic Geography at Columbia University.

Further evidence of these influences is provided in the second and third chapters of the book which can be considered as introductory geographical sketches. The chapter entitled "Alberta" deals with the location and nature of the province, its transportation handicap and its people and places; while "Alberta's Resources" is devoted to agriculture, forestry, minerals, hunting, fishing, and tourism. Then, after a short chapter on the petroleum industry in general, the story begins with the early oil discoveries—the Athabasca tar sands, Turner Valley, Wainwright, and Jumping Pound, until "on November 20th, 1946, an Imperial Oil . . . crew . . . spudded in a well at a location 13 miles southwest of Edmonton and a few miles northwest of the town of Leduc." Leduc then had a population of 920. Now it has over 2000. Devon, which was established as a completely new community some 10 miles away, now has 1500 people. These are but some facets of the change brought about in the geography of Alberta by the Leduc discovery. It led to further exploration and development, of which Redwater and Pembina were the most significant; to the construction of refineries and oil and gas pipelines, and to the development of markets for crude oil and gas. These, in turn, resulted in a tremendous rise in capital expenditures in Alberta, particularly for roads, schools, hospitals, waterworks, housing, and manufacturing establishments.

At the beginning of the "dynamic decade" the percentage of total personal income in Alberta generated by agriculture was 78 per cent, and by the petroleum industry 5 per cent. At the end of the decade the proportion generated by agriculture had dropped to 41 per cent while that generated by the petroleum industry had increased to 45 per cent. Professor Hanson sums it up neatly—"Currently, then, the fortunes of the Alberta economy are dependent upon two great industries instead of one."

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Historical Geography of the North Carolina Outer Banks, by GARY S. DUNBAR. xii and 234 pages; maps, ills., index, bibliog. Coastal Studies No. 3 of Louisiana State University Studies. Louisiana State University Press, Baton Rouge, 1959. $3.00. 11 x 8½ inches.

One of the more encouraging signs of professional growth in contemporary American geography is the rennaissance of the monograph

as a literary form. University presses are moving, particularly through reprints of student dissertations, to provide an outlet for scholarly publication more comprehensive than the journal article and more specialized than the omnipresent text. Geographers have had one such opportunity since 1951 in the Louisiana State University Studies. The volume under review, Gary S. Dunbar's *Historical Geography of the North Carolina Outer Banks*, is Number 3 of their Coastal Studies Series. Fred Kniffen acted as editor and co-researcher.

Historical geography is a very sticky area in which to work, since the term means many things to different geographers. Although Dunbar's work contains no stated working definition, it is evident that his point of view follows the pattern associated with Carl Sauer; that is, the work is a study of cultural evolution in a somewhat homogeneous natural landscape. The distinction between historical geography and history is, therefore, not the fundamental one of spatial vs. temporal organization. The difference is apparently found in the inclusion of certain items, such as plant introductions, house types, etc., which the investigator as a geographer wished to stress and of course the omission or less full development of other items of historical interest which people of other disciplines might rather include. It is then an historical study of a cultural landscape, a holistic type endeavor with certain stated omissions and with stress generally on economic developments.

The Outer Banks, for purposes of the study, is a region delimited by a physical boundary, the width of the barrier and proximate islands themselves, on the east and west; a political boundary, the Virginia–North Carolina state line, on the north; and a settlement limit, Portsmouth, N. C., on the south. The major chapters of the book divide along conventional historical lines: the exploration period, the colonial period, the Federal period, and the modern era (since 1865). The chapter on the period of exploration represents a thorough combing of standard sources, such as Hakluyt, as well as many far less well known, for references bearing on the area. The author goes outside his areal limits to include information about climates, plants, and animals from the Jamestown colony, source region for early Banks settlement. We are disabused of the persistent notion that the early Bankers made their living from plundering wrecked ships, but piracy and smuggling supplemented income derived from stock raising in the colonial period. Navigation improvements, windmills, gathering of yaupon, and the rise of a fishing industry are discussed in the chapter on the Federal period. Here Dunbar makes one of his departures from strictly economic history and describes military operations on the Banks during the War of 1812 and the Civil War, notably the familiar expedition by the incompetent General Ben Butler.

Chapter five, "The Banks in the Modern Era," is the longest and may be of particular interest to the student of the contemporary in economic geography. Changes in water transport capabilities within the region are noted, and the influence of government action, especially of the Corps of Engineers and the National Park Service, is evident. That the author's field time was well spent shows up especially in the detailed and interesting account of subsistence and commercial fishing and related economic activities. The natural advantages and historic traditions of the region as a vacation area became more apparent with the establishment of the Cape Hatteras National Seashore Recreation Area in 1953, and the author rightly points to the prospective increase in the tourist business as a new and major source of income.

Although a share of the report is based on field study, the author has spent much time in the library. The bibliography is a full one, with references on a variety of subjects, some from unpublished materials. Sources are skillfully handled. The footnotes are grouped at the end of the volume, and are not simply citations of sources; many contain all sorts of interesting information amplifying points in the text. There are seven maps, illustrative or simply locational rather than essential to the analysis. One misses in the study, for example, a land use map, or any evidences of field mapping. Photographs are often illuminating, sometimes superfluous, as the one of an abandoned gun club, which might have been anywhere. Some are reproductions of early photographs, which add flavor to the narrative.

Yet the professional geographer or historian reading the report must sense two shortcomings which prevent the work from having the impact it might have had. The first of these deals with content. The work taken as a whole suffers from the lack of a precisely defined problem and the rigorous subordination of each selected bit of information to that problem. A general occupance study, even of a relatively small area, through historic time is far too broad in scope to be treated with thoroughness in less than 80 pages of typewritten main text. The weaknesses of the report are in large part the weaknesses of regionalism, of the heterogeneous study of landscapes restricted in area and not sufficiently in topic or time period as well. The alternatives would be either to expand the length of the work very considerably, or to cut the emphasis on time sequence and organize the material spatially, as a series of cross-sectional views corresponding to stages in the economic development (if such can be isolated). Had all information which did not illuminate these economic landscapes been resolutely omitted, the result might have been a more

perceptive study and certainly acceptable historical geography.

The second consideration is the broader one of interpretation or context. For the most part the work is narrative and descriptive only. In the last paragraph, though, the writer summarizes as follows: "When one reduces the economic history of the Banks to a series of stages, one sees that the progression has been from stock raising to fishing and finally to the tourist business. This pattern is by no means unique to the Outer Banks. It was first developed in the coastal areas and islands of New England and the Middle Atlantic states, ... Natural evolution, not conscious repetition, caused this pattern to be repeated on the Outer Banks."

The first objection is that this progression has not been clearly established and studied as such in the body of the text. The author's role throughout has been that of a chronicler, not an analyst of causative factors or a tester of the generalizations of social science. Second, if the stages were indeed there, they were certainly not caused by "natural evolution." An arbitrarily selected "landscape" is but the summation of conditions within an area at a given time, and can scarcely be held to evolve as a unit organism. The changes in principal modes of economic occupance have been the results of changing market conditions, the shorter work week, improved modes of transport, proximity to urban centers and the concentration of high per capita income, and a number of other economic and social factors not considered in the text. To limit one's study to an inventory of the contents of an arbitrarily definable area is one's own option, but to ascribe to "natural evolution" those changes which are in fact the result of human choice and circumstance is to chase a bewitching phantom, sired by Darwinism out of determinism. Surely the geographer must not slight the factor of relative location in the pursuit of regional understanding.

The author is to be commended for his skill in the techniques of field observation and library research. His style of writing is pleasing, his exposition of information clear. The book, unlike so many dissertations, maintains reader interest throughout. The early maps consulted in the preparation of the study have been published elsewhere and may profitably be consulted while one reads the book. As a useful introduction to the Outer Banks, geographers may wish to use it in course work as outside reading or for class reports. The area as Dunbar paints it is an attractive one, and no doubt readers of the book will make it a point to stop off in their travels in the Southeast. Those whose interest in that area does not extend beyond the armchair will find here an interesting evening's reading.

As far as the broader field of historical geography is concerned, this book is one more example study to swell the somewhat slender library shelf of modern books in that line of research. Such studies are representative of a growing urge in American geography to recognize the mutability of landscape patterns, and to make use of explanations not derived solely from present conditions. As such it is a healthy trend, but much more attention is needed to the philosophical assumptions on which our investigations into the past are based. Not all geographers will care or be qualified to make such studies into the past; from those who are, Mr. Dunbar among them, we may anticipate worthy contributions to the professional literature.

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